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William Crookes.

[See page 99.]

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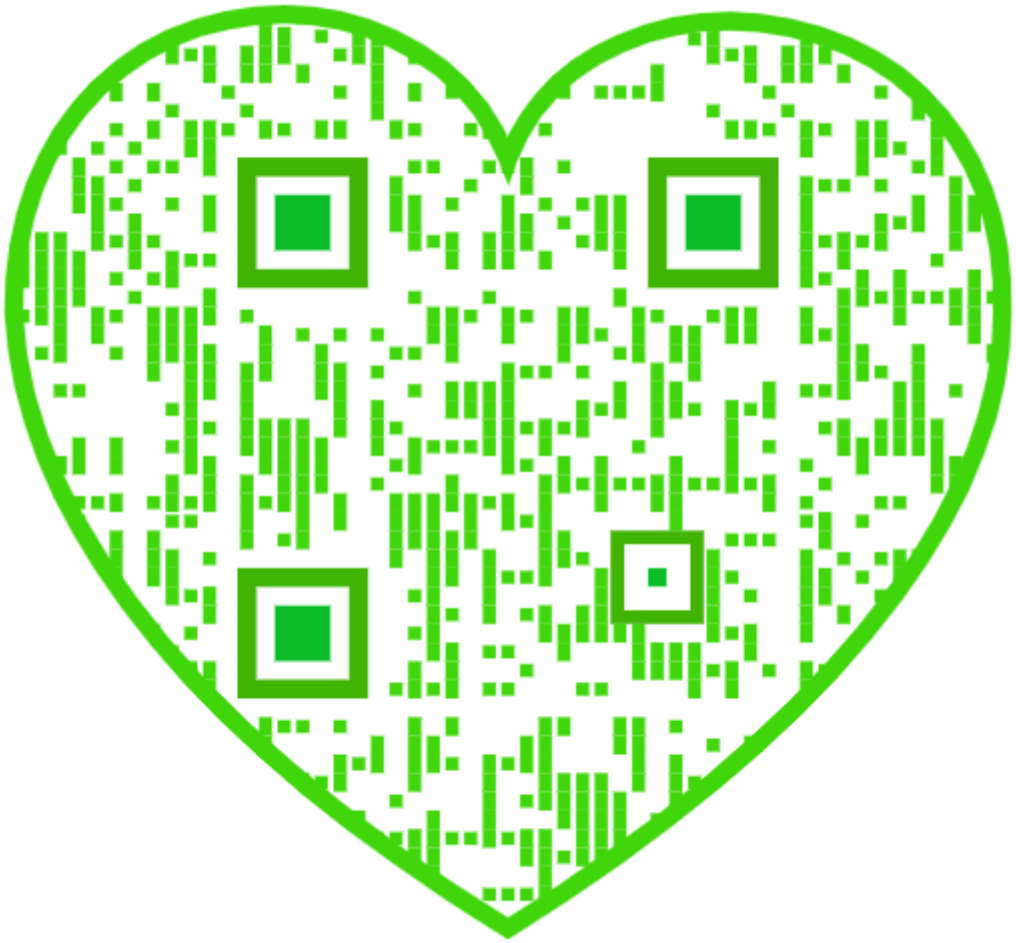

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NEW YORK, SATURDAY, AUGUST 8, 1903.

The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE TRANSATLANTIC RUN OF THE "KEARSARGE."

The notoriety given by the public press to the recent run of the battleship "Kearsarge" across the Atlantic at an average speed of 13.1 knots an hour, and the mutual felicitations indulged in thereat, must have proved somewhat puzzling to the average layman, who is accustomed to read on any day of the week that such and such a transatlantic liner has come into port after making the same transatlantic run at an average speed of 23 knots an hour or over. "Why," he must have said to himself, "all this jubilation because a first-class battleship has sailed the seas at a speed which would be only respectable for one of the better class tramp steamers?" Not only must the average speed seem to be in itself very low, but he will probably have in mind the fact that four years ago, when the "Kearsarge" underwent her official trials, she maintained for four hours an average speed of 16.84 knots an hour. "Why, then," he will say, "must we have all this mutual congratulation over a United States battleship which, on a specially-ordered sea voyage, cannot come within four knots per hour of the speed she made on her acceptance trials?"

And yet, in spite of the apparent discrepancy, this run of the "Kearsarge" was a really creditable performance, since it was made entirely under natural draft and at an average speed only one knot lower than her natural draft speed at the time she was built. Battleships and cruisers are designed to steam at varying rates of speed according to the particular needs of the occasion. For cruising purposes and making such long runs as that which she has just completed, the "Kearsarge" was given sufficient motive power to enable her, when steaming under natural draft, to maintain a speed under favorable conditions of 14 knots an hour; and in order to give the vessel a reserve of speed which she can call upon when she is chasing or being chased by an enemy, or when she wishes to avoid torpedo attack or to make some sudden change of position in a naval engagement, she carries a set of blowing engines by which the rush of air through the furnaces can be speedily augmented, and the steam-raising power of the boilers and the horse power of the engines proportionately increased. Under the latter conditions, the speed increases nearly three knots an hour; and as a matter of fact, on her trials carried out in 1899, the "Kearsarge" during a forty-hour continuous run under natural draft, maintained an average speed of 14.1 knots an hour, and during a forced-draft trial of four-hour duration, she showed an average speed of 16.84 knots per hour. It will be seen, then, that on the recent run across the Atlantic, the performance of the ship was within one knot per hour of the speed achieved under natural draft during the highly favorable conditions of an official trial.

Unfortunately for the subsequent reputation of battleships and cruisers, the maximum forced-draft speed achieved under exceptionally helpful conditions is invariably taken as being the speed of that ship; that is to say, she is credited, not with the speed which she will show for 360 days out of the 365 of the year, but with a speed which she may not use more than two or three times in the year, and which she can only reach when she has the best of coal in her bunkers, and when the boiler-room crew is in a state of first-class efficiency.

Hence it is misleading to talk of the 18-knot "Maine" and the 17-knot "Kearsarge." It would be nearer the truth to call them respectively 15-knot and 13-knot vessels.

Furthermore, the wide difference in speed between naval and merchant vessels, or say between a "Kearsarge" and a "Deutschland," is not in any sense due to imperfect design or poor handling in the former. For we must remember that while the "Kearsarge" required during her transatlantic run only about 6,500 horse power to drive her at 13.1 knots, the "Deutschland" in making her record trip at 23.5 knots, required over 37,000 horse power, or nearly six hundred per cent more power. Moreover, the model of the transatlantic liner is designed specially for high speed; for with a beam of 68 feet she has a length of over 680 feet, a ratio of beam to length of 1 to 10; whereas the "Kearsarge," with a beam of 72 feet, has a length of only 368 feet, a ratio of 1 to 5. The finer lines of the merchant vessel and her high freeboard are not only conducive to speed in ordinary still water, but they are especially helpful when driving into a head sea. We have traveled on the "Deutschland" when with 35,000 horse power she was maintaining 21 knots an hour in the teeth of a heavy southwesterly gale. The "Kearsarge," on the other hand, was obliged to slow down at times to 10 knots an hour on the same western trip, because she was taking green water over her forward turrets.

The run of the "Kearsarge," therefore, was highly creditable, and had it not been for obstructions of fogs, icebergs, and heavy weather, it is likely that the vessel would have about maintained her trial speed of 14.1 knots per hour.

THE BEHRING STRAIT TUNNEL AGAIN.

Once more the chimerical scheme for building a railroad from the Pacific coast terminus of the transcontinental railroad systems to Alaska, and carrying the road beneath the Behring Strait by a tunnel to connect with an extension of the Siberian Railroad, is being agitated. The improbability of such a railroad being built, or if built, being made financially successful, can only be understood by taking a map of North America and tracing the proposed course of the line. It will then be seen at a glance how vast are the distances which this proposed road must cover. From Vancouver on the Canadian Pacific line to Behring Strait is at least 2,500 miles. The Behring Strait would involve a tunnel nearly sixty miles in length, that would have to descend several hundred feet below sea level to find a stratum suitable for tunnel operations; then on reaching the Asiatic shore, there would be another stretch of about 2,700 miles to be surveyed and constructed before connection was made with the present Trans-Siberian system. The difficulties in locating and building such a line can only be understood by engineers who are familiar with the physical and climatic obstacles to be overcome. No mere hasty reconnaissance would be sufficient to give even an approximate estimate of the cost of the Trans-Alaskan portion of the route. As to the construction of the tunnel, the mere preliminary borings to ascertain the character of the material to be encountered would be an enormously formidable task in itself, and when this was successfully completed, there would still be a grave element of doubt as to the practicability of keeping the tunnel free from an inrush of water which, if it should occur under the pressure due to the great depth, could not fail to be disastrous.

We are aware that the enthusiastic promoters set down the cost of the 60-mile tunnel at twenty million dollars; but when we consider that the twenty miles of subway tunnel in this city are to cost thirty-five million dollars, it is pretty safe to say that the twenty million dollars would not be sufficient to cover the cost of the tunnel and the surveys, to say nothing of the 5,000 miles of connecting railroad that would be necessary. Even if the engineering difficulties could be overcome (as undoubtedly they could with sufficient time and capital), where is to be found a body of financiers to put through an undertaking which could not possibly render any return on the investment for many a decade to come, if ever it did?

Moreover, even if the road were built, it is pretty safe to say that it would have to depend almost entirely upon the passenger and local traffic for its development; for it could not possibly hope to compete in the carriage of freight with the large merchant steamships that are being built for the Trans-Pacific trade. The idea of an all-rail route from Paris to New York is picturesque, sentimental, and quite impractical. It is certain that in the present stage of development of Northwestern America and Northeastern Asia, the scheme will never get beyond the paper stage.

THE SPEED OF THE AUTOMOBILE.

There is something in high-speed travel that appeals, with the strongest fascination, to the general public. Just why a record-breaking run should have such fascination, it is difficult to determine; but perhaps it is that, unconsciously, we realize that every mile per hour added to our high-speed records is another evidence of the gradual victory of man over that all-pervading inertia which it is his constant effort to overcome.

The present year has witnessed some remarkable feats of speed, particularly in the field of the automobile. Unquestionably, the most astonishing performance was that of Gabriel, the winner of the first stage of the Paris-Madrid race, who covered a stretch of 331.2 miles at an average speed of 56.25 miles per hour. To maintain such a high average over roads that are more or less hilly must necessitate extremely fast running over certain portions of the road.

Although the meet for the Gordon Bennett cup, recently chronicled in this journal, did not witness any such high average speed as was achieved in France, the speed trials for short distances were the most successful ever held. Although it is true that the course in Phœnix Park is an ideal one for speeding, we must admit that the performance of Baron de Forest, when he lowered the world's record for a kilometer to 26 3-5 seconds, which is equal to a speed of 86½ miles per hour, is truly astonishing. No less astounding, either, is the record of Barney Oldfield, made recently on an oval track, of a mile in 55 4-5 seconds, or at a rate of 64½ miles an hour.

As far as we are able to ascertain, the highest speed attained by a railroad train on a trial that was properly tested by competent time-keepers, was a fraction of over 90 miles per hour, so that the automobile is to-day practically as fast as the locomotive. Of course, it is a very different proposition to run a single machine capable of carrying only two persons at high speed, and to do the same thing with a train capable of carrying three or four hundred people. The fact that nearly 90 miles an hour has been achieved by an automobile proves that it is merely a question of weight and horse power before these machines will be running a trial mile at the rate of one hundred miles an hour or over. Such performances, however, are merely sensational and spectacular; they have no practical value, except so far as they may afford data to the automobile makers on the action of the more delicate and sensitive parts of the engines when they are pushed at their utmost limit.

MARVELOUS PRODUCTION OF IRON AND STEEL.

In spite of the fact that during the past twelve months the iron and steel industry has been hampered by a long coal strike, and by something of a deadlock in transportation facilities, the total production of iron and steel in the United States has grown to truly enormous proportions. Probably in the whole history of the world there has never been a period when a single industry witnessed such a phenomenal development as that of the American iron and steel trade. We have been accustomed to regard the great industrial establishments of the country, and particularly those identified with the steel industry, as more than equal to any possible demands of the home market, yet so great has been our prosperity that our great blast furnaces and steel mills have been unable to cope with the demand, and it has been necessary to import a certain amount of pig iron from abroad.

During the last year the total production of pig iron was 17,821,307 tons, an increase of over two million tons on the preceding year and a gain of four million tons over the year 1900. Perhaps these figures are best understood when it is stated that last year's production was nearly double that of the year 1897.

THE SLAUGHTER GOES ON.

The rate at which our railroads are killing and maiming people continues steadily to increase. According to the report of the Interstate Commerce Commission on Railroad Accidents in the United States, within the three months ending March 31 last, 300 people were killed and 2,834 injured in train accidents. Other kinds of accidents, including those sustained by employes while at work, run up the total casualties to 827 killed and 11,481 injured. That these accidents cannot be put down entirely to the fault of the passengers and employes themselves is shown by the fact that during the quarter under consideration, 1,650 trains were in collision and 1,181 trains were derailed.

MORE NEWS ABOUT EDISON'S STORAGE BATTERY.

The latest authentic data concerning Mr. Edison's storage battery are found in the following interview published in the New York Times:

"The popular impression seems to be that my new storage battery was more or less a possibility, but that it began and ended there. That is not so—one of them has been in operation for the last three weeks in one of Altman's delivery wagons, and is doing all that I expected and claimed for it.

"There is a great deal to be said for the new battery, and all in its favor. It will average more than a third greater mileage for half the weight than will the old lead battery. It has an additional advantage inasmuch as it can be recharged at a much faster rate than the old battery. As much electricity as will send the motor forty miles can be put in it in less than an hour.

"Ever since I took up this problem of the greater capacity battery I have worked with the idea of using it for street locomotion—in automobiles and trolleys. And now the auto battery is finished. Last Monday three friends and myself took a trial run to Atlantic City in a car consisting of a Mors frame and one of

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my batteries. We wished to attain great velocities over rough surfaces, and we succeeded beyond any of our expectations. The idea was to find any defects in either the frame of the car or the battery and motor. The latter two were entirely successful, but there are a few things which can be bettered in the car.

"My experience shows me that we have much to learn from the French makers—they have been at it longer than we have, and are still several years ahead. Several of the auto makers in this country have sent for my battery specifications and are beginning to make types of their machine in which it is to be used.

"I have been experimenting with an electric coach to-day, and it is surprising how well it showed up. We climbed Eagle Rock, where the hill-climbing contests are held, with the greatest ease, and we really did not dare to attain our maximum speed.

"We cannot put the new battery on the market in any quantity as yet. The best we can do now is to make one a day. By October we will make at least six daily, and about Christmas we will be in shape to meet any demand. The trouble has been that special machines had to be built, but the last of these will be completed next week. Another disadvantage I have to contend with is paying 40 per cent duty on a certain sheet steel that must be imported from England or Germany, and then in only limited quantities. By Christmas three rolling mills will be able to make it for me here in this country, and then the present high price for the batteries will be reduced.

"This battery will drive all other methods of locomotion out of business, and in less than ten years the horrible odor of gasoline on the public highways will be unknown. As for lack of recharging stations, that is nonsense. In the last month forty-five new ones have been installed in the New England States alone, and this is going on all over the country.

"Next year I will wager that I can take a car of my own design, fitted with my motor and battery, and go to Chicago and return in less time and with more pleasure than any other machine in existence. There will be no breakdown, no explosion of gas or gasoline, and the trip will be made at an even twenty-five miles an hour.

"Another thing, the battery will be made in four sizes, so that when fully charged it will run 25, 50, 75, or 100 miles, and if wanted, they will be made any size larger or smaller. Of course, the running power of the battery will depend to a certain extent on the work it is called upon to do. If the roads are rough and there are many hills, a charge will last a shorter time than if the conditions were such as are found in the city. But taking the maximum of bad going, the battery will only be exhausted about 25 per cent sooner than it would be under favorable conditions."

In looking up the official test made of the new battery in the delivery wagon at Altman's, the books showed that the old lead battery weighed 1,260 pounds and had a maximum of 25 miles, while the Edison battery which replaced it weighed 650 pounds and drove the wagon 36.8 miles. Besides which the old battery occupied 12.8 cubic feet, while the Edison took up only 8.5 cubic feet. This comparison was made by the Times.

PROPOSED FORTH-CLYDE SHIP CANAL.

The feasibility of a ship canal between the Forth and Clyde has been for many years a subject of discussion in shipping and commercial circles in Scotland. Several routes were suggested at various times, but no definite steps have been taken toward the preparation of plans. At present the prospect of the construction of such a waterway is, however, considerably brighter. A company of London financiers is taking an active interest in the project, and has, it is said, adopted the scheme put forward by Messrs. D. and C. Stevenson, a prominent firm of harbor engineers of Edinburgh. Messrs. Stevenson surveyed the route some years ago from Alloa, on the Forth, to Arrochar, on Loch Long, and are now making a further survey in detail, preparing plans, etc. An Edinburgh committee or syndicate is acting in conjunction with the London promoters, and the sum of £10,000,000 ($48,665,000) has been pledged, on condition that Parliament shall guarantee interest on capital. The promoters are confident that Parliament will aid the enterprise to this extent, in view of the importance of the canal for naval purposes.

In regard to this proposed deep-water canal across Scotland, David Alan Stevenson, C.E., says:

"The east and west coasts of Scotland are now connected by two canals, namely, the Forth and Clyde, from Grangemouth, on the Forth, to Bowling, on the Clyde, and the Caledonian, constructed at national expense, between Inverness and Fort William. Both of these canals are quite inadequate to meet the present wants of shipping, as they can only accommodate vessels of a small class. The first named is mainly used by barges, while the Caledonian can only be used by vessels of about 150 feet in length, 38 feet beam, and 17 feet draft. Both canals are seriously incumbered by numerous locks.

"At present all vessels bound from the east to the west coast of Britain, or *vice versa*, have to pass around the end of the island, through the Pentland Firth, with its rapid tide and dangerous sea, combined with deceptive currents and prevalent fogs, or 'south about' through the overcrowded English Channel, so frequently the scene of disastrous collisions. It cannot be doubted that a ship canal through the narrow neck of land which separates the east and west coasts of Scotland, capable of carrying the largest vessels, would not only obviate all the dangers and delays incident to the 'north about' and 'south about' routes, but would effect much saving in time, in the cost of insurance, in wear and tear of vessels and their engines, and hence in the cost of transit; it would also for strategical purposes be of the greatest importance.

"In designing such a canal the first points to be settled were, What are the essential requisites? These may be stated as follows:

"1. That it should be of such dimensions as to admit ships of the largest class of merchantmen, and also vessels of the royal navy, passing freely and with perfect safety from sea to sea, practically at all times.

"2. That it should be as free as possible from locks, hydraulic lifts, or other mechanical appliances, involving possible delay or risk to ships using it.

"Having assumed these, as I think, indispensable conditions, the next question for solution was, Can a route be formed from the German Ocean to the Atlantic which fulfills them, and also can the canal be formed at a cost which will prove remunerative?

"After careful study of the country and the levels, the conclusion was arrived at that a route along the valley of the Forth gives the only practical solution of the problem. There is, as is well known, a tract of country, extending from Alloa, on the Forth, westward along the valley of the Forth to within about 10 miles of Loch Lomond, where the surface of the ground is only from 30 to 50 feet above mean sea level and the stratum is an alluvial deposit. Between this and Loch Lomond the ground rises rapidly and attains a maximum height of 236 feet above mean sea level and dips again to the south end of Loch Lomond, the surface of which is only 22 feet above mean sea level. The distance across this higher ground, from the 50-foot contour on the one side to the 50-foot contour on the other, is about 8 miles, 1¾ miles of it being above the 200-foot line.

"Loch Lomond (which has ample depth for vessels of the largest draft) is to be utilized as canal toward the north end of the lock to Tarbet, and thence across to Loch Long there is only a distance of 1¾ miles, the ground attaining a maximum height of 130 feet above the mean sea level. Loch Long is practically the Atlantic Ocean, and the navigation of it is safe and the water of ample depth. This, then, is the route proposed by my firm, and the surface of Loch Lomond, which as I have said is only 22 feet above the mean level of the sea, is the proposed summit level of the canal, and having a water area of 21,000 acres and ample gathering ground—290 square miles—it would form an inexhaustible reservoir for supplying the locks with water. Only two locks at either end, at Alloa and Loch Long, would be required, as the level of the canal is only 13 feet and 17 feet above high-water level at these places, respectively. The exact route to be chosen will, of course, depend upon more minute inquiry than has yet been made.

"The eastern approach to the canal, which will be tidal, will be formed by deepening the Forth or making a cut inland, with a depth of 25 feet at a low-water spring tides, from opposite Grangemouth to the locks which it is proposed should be placed about 2 miles above Alloa. This will give a depth of 43 feet at high-water spring and 38 feet at neap tides. The distance from Grangemouth to Alloa is 6 miles. From Alloa the canal will pass to the north of the links of Forth and to the northward of the town of Stirling, then along the valley of the Forth to Gartmore and enter Loch Lomond near the mouth of the Endrick, a distance of 29 miles.

"Near the Loch Lomond end there are 5 miles of high ground, which, according to the geological survey, is the old red-sandstone formation. This part of the work will be open cutting. The distance from the junction of the loch and canal to Tarbet is 14 miles, and across the neck of land to Loch Long 1¾ miles. Loch Long is 15 miles in length to its junction with the Firth of Clyde. The total distance from Grangemouth to the Firth of Clyde is 65¾ miles.

"Regarding the dimensions of the canal, it is essential to its success that it be made on a large scale and free from locks, excepting at the seaward extremities. As the level of the water of the canal will be only about 13 feet above high water, one lock will be sufficient at high water, but two may be necessary at other times of tide. It is proposed to make the canal throughout with a depth of 30 feet, with a width at the bottom the same as the Suez Canal—namely, 72 feet—and side slopes varying with the nature of the material. The locks will be capable of passing the largest vessels afloat, or about 600 feet in length and 80 feet in width, with smaller locks alongside for smaller vessels.

"It would have been desirable to have proposed a canal of sufficient width to allow two of the largest vessels to pass each other at any place on the route; but in roughly estimating the cost it was found that this would involve so large an expenditure as to make it doubtful whether such a work would, in the meantime, prove remunerative. Frequent passing places, however, will be made at suitable intervals.

"There are no very serious difficulties to be overcome; though the cutting is no doubt a heavy one. There are few railways or road crossings of any importance, and the excavations are largely in soft material and the disposal of the excavations could be easily effected, owing to the proximity to the canal banks of waste ground.

"A ship canal of these dimensions would not only accommodate merchant vessels, but would prove of the greatest advantage to His Majesty's navy, as the largest ships of war at present in existence could pass through from the one coast to the other in about eight hours, and thus the facility for defending the coast in time of war would be very much increased.

"It is believed that the route suggested through the Forth Valley would prove the most satisfactory for a ship canal. Both approaches are in smooth water and free from every danger to navigation. The western outlet into Loch Long is exceedingly favorable, as ships of the largest class could at once proceed to sea quite free from the interruption and liability to grounding which they would meet with had the canal debouched into the River Clyde. The entrances to the Forth and Clyde are now so well marked by lighthouses and fog signals that vessels of any burden can run for these waters with the most perfect confidence.

"When considering the best route for the canal after vessels enter Loch Lomond, two other routes were feasible besides that already described:

"1. Across Lock Lomond to the opposite shore near Arden and then by a cut about 4 miles in length, partly open and partly in tunnel, to the Clyde to the northward of Ardmore Head.

"2. Along Loch Lomond to its southern end and through the vale of Leven to the Clyde at Dumbarton.

"The relative merits of the different routes from Loch Lomond to the sea, so far as distance is concerned, are as follows:

	Miles.
Tarbet route (Endrick to mouth of Loch Long)	28
Arden route	14
Dumbarton route	20½

"The Arden route is therefore the shortest, but it would be the most expensive, owing to a length of tunnel of 1¾ miles, which could not be overcome by open cutting, as it passes under land about 300 feet in height. The Dumbarton route is shorter than the Tarbet route by about 7½ miles, but as the Dumbarton route involves 5 miles additional canal, where vessels could only go about 5 miles an hour, and 6 miles of the Clyde, where the speed will probably be restricted to about 8 miles an hour, the time occupied by the journey either way will be about the same. In steaming up Loch Lomond and also down Loch Long vessels may go at full speed, and there would be no interruption from river traffic.

"The cost of the undertaking cannot be more than approximately estimated without particular investigation as to the nature of the strata in the line of the canal; but my firm estimate the cost of the Tarbet route, with their present knowledge derived from the ordnance and geological surveys, and including interest during construction, at £10,000,000 ($48,665,000). The cost of the management and maintenance my firm estimate at £60,000 ($291,990).

"The saving in distance that would be effected may be stated thus:

"1. From the Clyde to ports on the east coast of Scotland, northeast of England, and northwest of Europe the distance saved would be from 529 miles to 238 miles, in the majority of cases the distance being much more than halved.

"2. From the Forth to ports on the west coast of Scotland, northwest of England, Ireland, America, and the Mediterranean the distance saved would be from 487 to 141 miles; in all cases, except the American and Mediterranean route, the distance being more than halved.

"3. Tyne ports to the St. Lawrence River, the distance saved would be 150 miles.

"4. West of Britain and northeast of Ireland to middle western ports of the Continent, the distance saved would be from 377 to 98 miles."

The canal will affect an enormous tonnage, estimated by the sanguine engineers at 9,500,000 tons per annum. At an average rate per ship and cargo of 1s. 6d. (36 cents) per ton, this would yield a revenue of about £700,000 ($3,406,550).—Rufus Fleming, U. S. Consul at Edinburgh.

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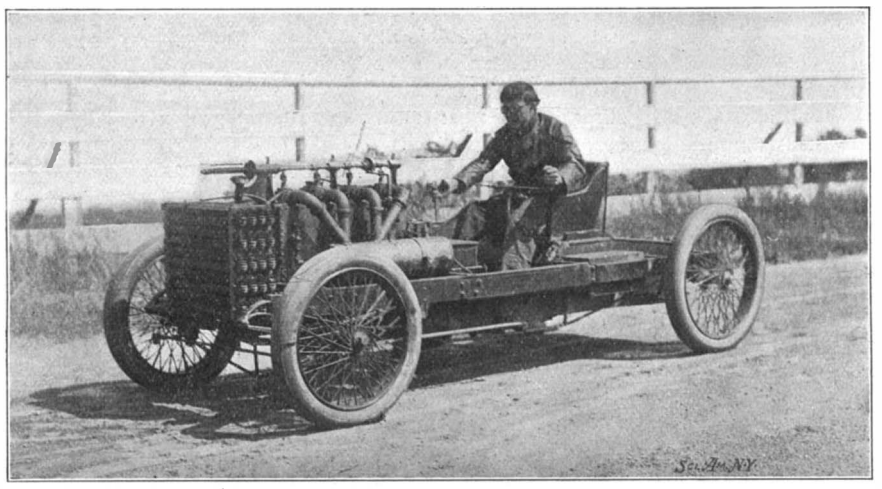
RECENT AUTOMOBILE TRACK RECORDS.

The midsummer automobile race meet at the Empire City Track, Yonkers, on the 25th ultimo, was devoted exclusively to the lowering of records by gasoline racers, although several of the events were open to machines of any kind of power.

Barney Oldfield, on the Ford-Cooper racer with which he has been steadily lowering track records since he first drove it a mile in 1 minute, 1 1-5 seconds on December 1, 1902, once more reduced by three-fifths of a second his previous record of 56 2-5 seconds, made on the 4th of July last, at Columbus, Ohio. His new time is accordingly 55 4-5 seconds, or a rate of speed of 64½ miles an hour. This is faster than most express trains go on a straight line of rails, and what it means to ride on a machine that turns sharp corners while going at this rate, can scarcely be imagined by one who has not seen it actually done. Every time Oldfield's racer started to make a turn, even though he kept close to the outside fence and turned the front wheels very gradually, the rear end of the machine would skid around so far that the whole car appeared for the moment to be aiming straight for the inner fence. In an instant it would straighten out again, however, skim round the bend, and dart along the farther side of the course at more than express train speed, only to be seen a few seconds later making its last turn amid a cloud of dust, and then its final rush down the home stretch. Recognizing the tremendous speed at which Oldfield was running his machine, the spectators cheered him as he finished, and a moment later, when the time was announced, all present realized that they had seen a new world's record made. Oldfield rounded the course a second time at high speed and coasted up to the starting point. This was invariably the custom, in bringing the fast machines to a stop. The new record was made, of course, with a flying start, the racer having been first towed backward to the end of the track, where the motor was started and the machine got up to speed in the quarter of a mile before it crossed the line.



Barney Oldfield on the 70 H. P. Ford-Cooper Racer, which made a Record Mile in 55⅘ Seconds.

Oldfield's race against time was the second event of the meet, the first being a five-mile race for machines of any motive power weighing less than 1,200 pounds. This brought to view another American triumph in the perfecting of automobiles, in the shape of a Franklin 10 horse power, four cylinder, air-cooled racer of 900 pounds weight, which won easily in 6:54 2-5, making the fastest time on the third mile, which was covered in 1:21 3-5. The time for each mile and for the entire distance was a new world's track record for light-weight machines. Darracq racing cars of 16 and 12 horse power were second and third respectively, while the little Orient buckboard, propelled by a 4 horse power air-cooled motor, took fourth place. As the Franklin, driven by John Wilkinson, its designer, also won a 10-mile race from Joseph Tracy in a 10 horse power Renault (time 15:50 1-5) besides making a mile from a flying start in 1:20 2-5, it can easily be seen that the day was one of victory in the racing line for the air-cooled motor, which, though discarded by its originators, the French, has been brought to such a state of perfection in America as, after completely demonstrating its practicability for touring, to be able to win against one of the fastest French light cars of equal power in a race 10 miles in length.

A 10-mile race for machines under 1,800 pounds was won by a 40 horse power Darracq in 10:52 4-5—a world's record for this class. A 40 horse power Decauville came in second in 11 minutes, 26 seconds. Both of these cars were survivors of the Paris-Madrid race, and were run on this occasion by the same chauffeurs who drove them in that event. A 35 horse power Darracq and a 35 horse power Panhard were third and fourth respectively.

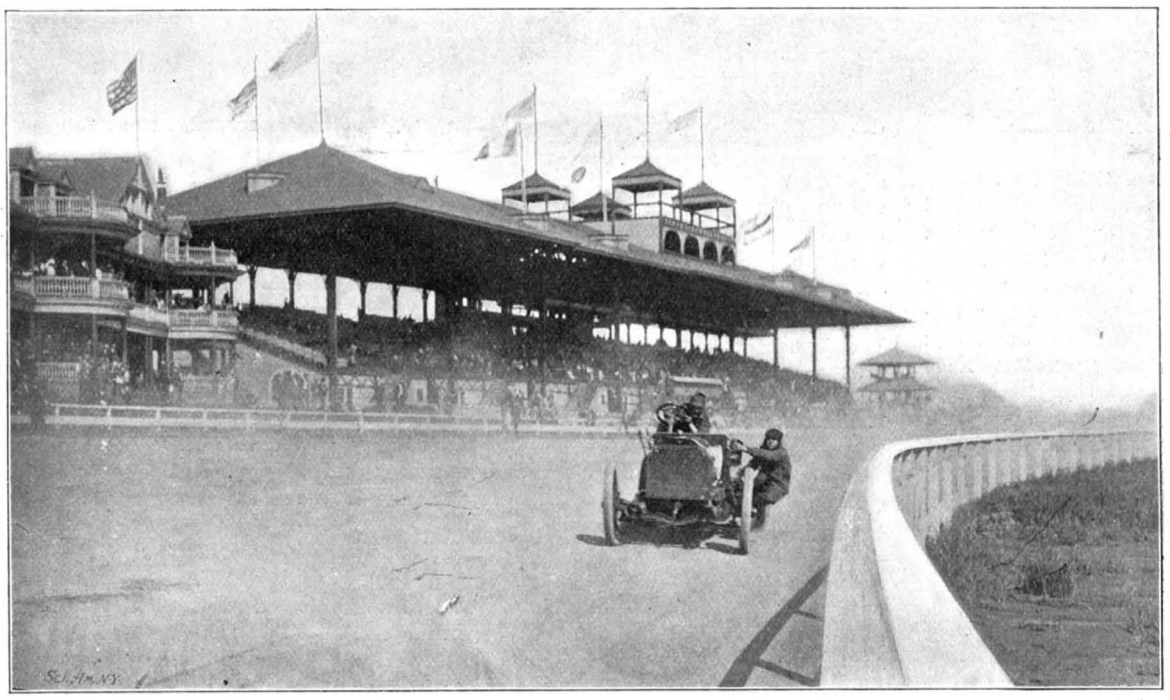
One of the most interesting events of the afternoon was an international 15-mile race, in which Mr. O. W. Bright's new 60 horse power Mercedes—a duplicate of the machine that won the Gordon Bennett race—represented Germany; the 40 horse power Paris-Madrid Decauville racer, France; and Louis P. Mooers' 80 horse power Gordon Bennett cup racer, America. The Mercedes took first place at the start and held it to the end. The steady, smooth, quiet running of this car is remarkable, and stamps it at once as a perfect piece of mechanism. It reeled off the miles at the steady pace of 1:04 3-5 with but fractions of a second variation, save once or twice. The first, sixth, and eighth miles were the slowest, being run in 1:10 2-5, 1:05 1-5, and 1:05, while the twelfth and thirteenth were each covered in 1:03 4-5, and the fourteenth and fifteenth in 1:04 and 1:03 2-5 respectively. The times for the last five miles were all world's track records. With the completion of the 15 miles in a total time of 16:10 4-5, Fournier's record for this distance was beaten by 3 minutes. The French Decauville finished second, tieing Fournier's old record of 19:10 4-5, after having made as good a performance as the Mercedes in proportion to its power. The highest-powered car of all took third place, and was beaten a full mile by the winner. It seemed to miss fire considerably, and consequently did not have very much speed.

The second great event of the day was two 5-mile heats between Oldfield on his Ford-Cooper racer and F. A. La Roche on an American-built Darracq. The machines were started at the half and mile posts respectively. They had to be started a second time, owing to the engine of Oldfield's racer missing fire badly in the first mile. The latter finally won both heats in 5:09 1-5 and 4:55 respectively, for, although La Roche's machine was a fast one, it seemed not to be in the same class with the Ford-Cooper racer as run by its dare-devil chauffeur.

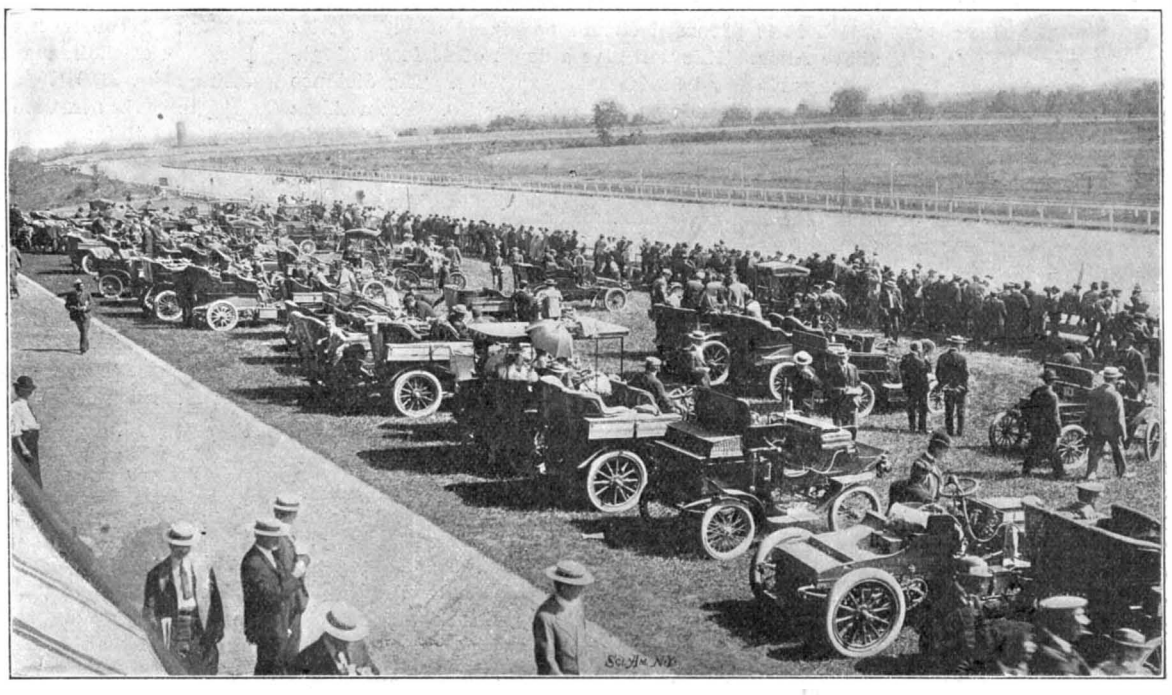
The final race was a 15-mile one for machines of any weight or motive power. It was won by the 40 horse power Decauville, driven by Henri Page, who brought it again to the finishing post in the fast time of 16:39 2-5. A 35 horse power Darracq came in second, and a 40 horse power Darracq third. The latter stood every chance of winning the race when M. C. Herman's 70 horse power Panhard dropped out on account of a loose valve spring, after leading during the first mile, until a punctured rear wheel tire gave out during the sixth mile and caused it to fall behind. Jules Sincholle, its driver, pluckily finished the race, however, with the spectators fearing an accident every moment from the rapidly demolishing tire.

The mile speed trials, made from a flying start, concluded the meet, and resulted as follows: 60 horse power Mercedes, 1:03 1-5; 70 horse power Panhard, 1:05 2-5; 40 horse power Decauville, 1:07 1-5; 80 horse power Peerless, 1:09 3-5; 35 horse power Darracq, 1:15 2-5; 10 horse power Franklin, 1:20 2-5.

The races were the most successful yet held in this country. Five or six thousand people witnessed them from the grand stand, and many rode to the track in their automobiles, and viewed the events from the seats of their vehicles, which filled the lawn near the track. Over three hundred machines were present in the inclosure, and the only horses seen were attached to two watering carts, which slowly sprinkled the course before the big events. It seems quite time for the firm that manufactures these machines to make them self-propelling, now that automobile lawn mowers, etc., are on the market, and this it ought easily to do, as it is turning out electric automobiles already. Then, in future meets, the horse will have vanished entirely, and none of the animals will be present to



O. W. Bright's 60 H. P. Mercedes Car Making a World's Record of 15 Miles in 16 Minutes, 10⅘ Seconds.



The Large Assemblage of Automobiles seen from the Grand Stand.

THE MIDSUMMER AUTOMOBILE RACE MEET AT THE EMPIRE CITY TRACK.

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remind enthusiasts in the sport that the horse is not yet a back number and may some day be needed to help them.

Complete illustrated descriptions of the Ford-Cooper racer and of the Franklin car have already been published in our issues of January 31 and April 11; and by reference to these numbers, any of our readers interested in the construction of the machines can obtain full particulars concerning them.

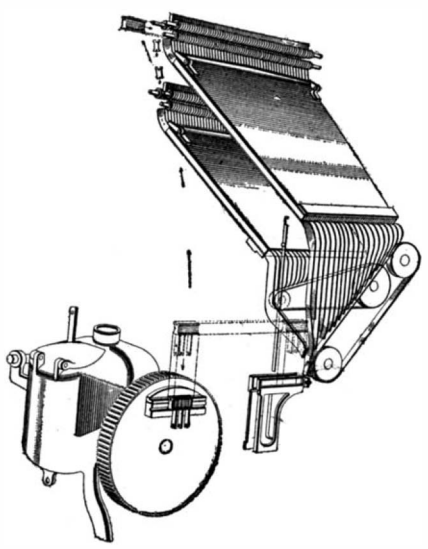
A MULTIFACE LINOTYPE MACHINE.

The original linotype machine, illustrated in the SCIENTIFIC AMERICAN, vol. LXX., page 17, is adapted for composing solid matter in one face or style of type only, without italics or small capitals, and to this end it contained a single set or font of matrices, each representing a single character. These matrices were selected by means of a finger-key mechanism, assembled in line with expanding spacers, in the order in which the characters were to appear in print; the composed lines were transferred to the front of a slotted mold and there justified by adjusting the spacers through the line to increase their thickness; the mold was closed at the front by the line of matrices, and was filled from the back with molten type metal issuing from the mouth of a melting pot provided with a pump or plunger. The result was a slug, or linotype bearing on its front edge in relief the characters formed thereon by the matrices.

After the casting of a slug the matrices were lifted to the top of the machine, and returned through distributing mechanism to the upper ends of the channels in the magazine from which they were delivered.

In the progress of the art it became necessary to adapt the machines to produce italics and small caps or black faces, in connection with the body faces. This was in order to adapt them for the demands of the book offices. This result was accomplished by providing each matrix with two characters, separately usable. A switch under the control of the operator was provided for the purpose of directing the matrices to the composed line, at a higher or a lower level, in order to cause the presentation of the upper or the lower character to the mold. By this simple modification of the original machine, it became possible to introduce italics, small capitals, or black letters, in connection with the body matter, without appreciable loss of time.

Within the present year a linotype of radically new design has been developed. This machine is provided with two magazines, each of which is adapted to carry a complete font of either single letter or double letter matrices. Both of these magazines are controlled from the ordinary single keyboard. By simply throwing a lever, the operator is enabled to cause the discharge of matrices at will from either the upper or the lower magazine. The magazines may contain two fonts of similar face differing in size, or fonts of the same size and different faces; or one may carry a font of matrices for body faces and the other an assortment of black letters, arbitrary characters, etc. Matrices for three hundred and sixty characters are carried at one time in the machine, and the operator is thus enabled to set matter in one face or another at will. The matter may be composed wholly of characters represented in the upper magazine, wholly of those represented in the lower magazine, or in part of each. By means of this remarkable machine, it becomes possible to set a page of any ordinary book, including a large body face, a different face for foot notes, extracts, etc., or chapter heads, side heads, etc., together with italics and small capitals, at approximately the speed of ordinary or straight composition. In short, this is the first and only machine by which complicated composition, involving a combination of different sizes or styles of type, ordinarily known as "two-price" matter, may be composed continuously and at approximately the speed of straight composition.



ARRANGEMENT OF THE MAGAZINES.

The matrices from the upper magazine are delivered, as usual, through vertical channels to the inclined assembling belt, from which they are delivered into the assembling elevator.

As shown in the accompanying illustration, the lower magazine delivers its matrices through guide channels to a second carrier belt, which, in turn, delivers them through a special guide or channel into the assembling elevator. After being used in front of the mold, the matrix lines are lifted to the level of the upper distributor. Matrices belonging in the upper magazine pass through this distributor to the magazine in the usual manner. On the other hand, matrices belonging in the lower magazines are permitted to fall from the line to a lower distributor, which delivers them to a second distributor overlying the lower magazine, to which they are delivered. The two distributors are alike in all respects. The matrices for the lower magazine differ from those of the upper only in having a distinguishing notch in the lower end.

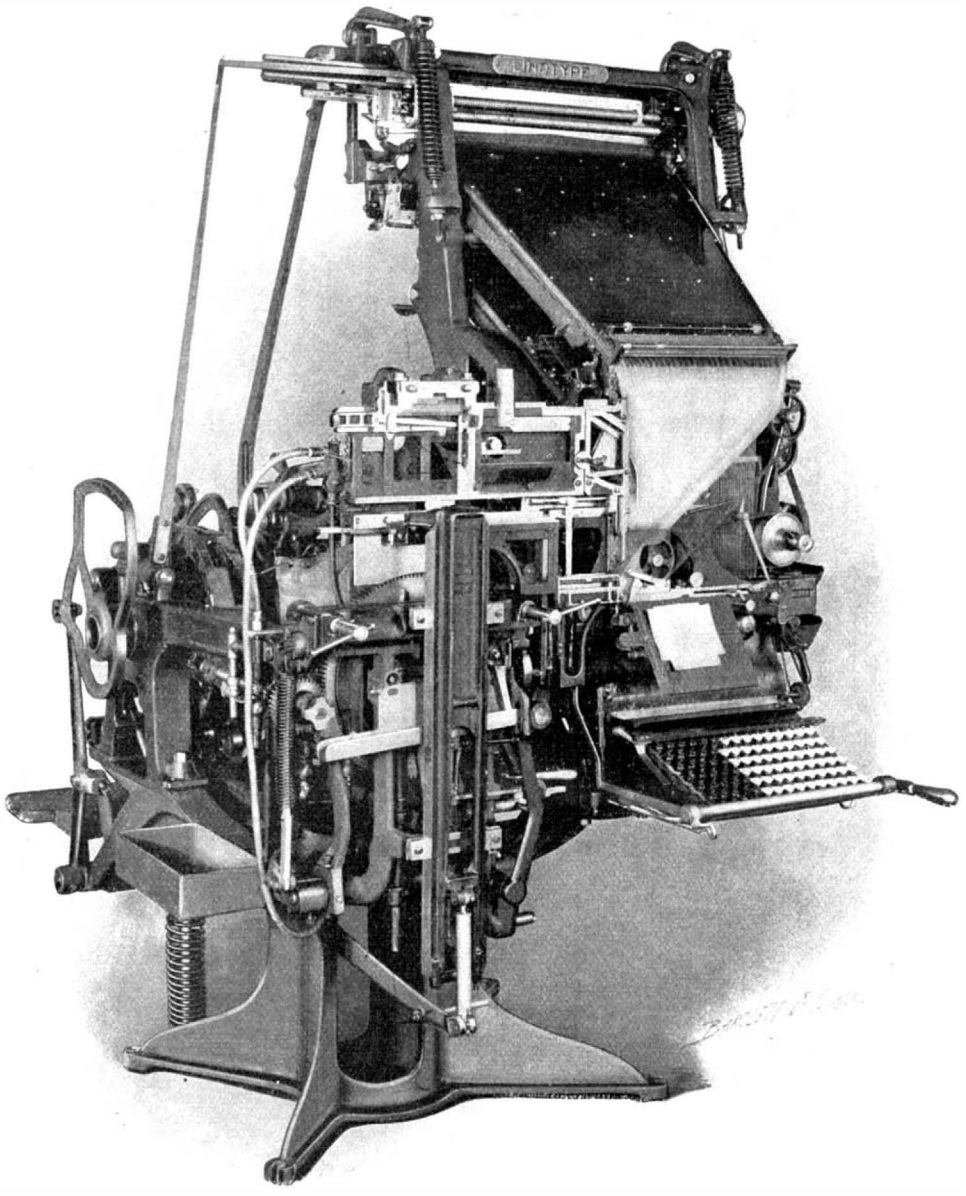
The linotype machine is so complicated, both as to its construction and operation, that we have not attempted in the limits of this article to do more than outline the new features of the machine.

The Monument of Mont Pelé.

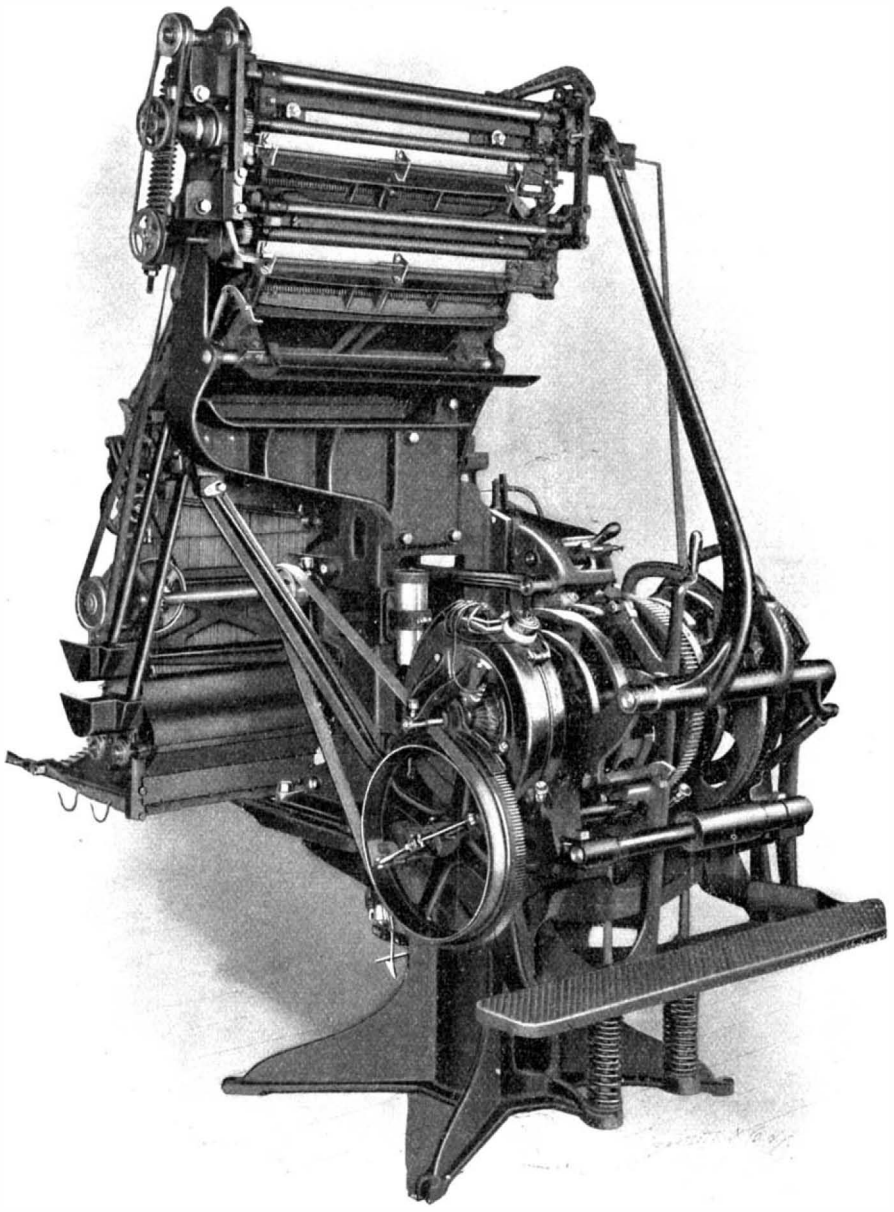
Prof. Angelo Heilprin, whose work in studying the Martinique eruptions is doubtless well known to our readers, announces a most curious and wonderful phenomenon which he had the opportunity of studying on Mont Pelé. He states that from the crater of the volcano there has been forced up a column 840 feet high, having a diameter of about 300 feet at the base. Prof. Heilprin asserts that he himself witnessed part of the upward movement of this enormous mass. He noted that in the space of four days there had been an elevation of 21 feet. It seemed to him, however, that the upward movement of the mass had slightly subsided, and that it had at one time been very great.

This natural monument, according to Prof. Heilprin, must have been twice as high and at least four times as thick as the Washington Monument.

Just what caused the upward projection of this material cannot very well be explained. Prof. Heilprin suggests that the internal stresses of the earth have forced out molten lava, which cooled sufficiently to solidify when it emerged. The phenomenon was all the more remarkable because no lava whatever was ejected in 1902. The account then published simply stated that ashes, rocks, steam, and gas had been vomited. It is not, however, impossible that there may have been a slight ejection of lava then, and that the present manifestation is simply proof that the disturbances have not reached low levels of lava.



DOUBLE MAGAZINE LINOTYPE COMPOSING MACHINE.



REAR VIEW OF DOUBLE MAGAZINE LINOTYPE COMPOSING MACHINE.

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ECCENTRICITIES OF THE STATIC DISCHARGE.

BY WALTON HARRISON.

In Fig. 1 is represented one of the fundamental experiments of Hertz. Two Ruhmkorff coils, *A* and *D*, of different sizes, are so connected that their primary windings are in series with a single interrupter *C* and a battery *E*. The secondary winding of the larger coil *A* is provided with ordinary spark terminals *B*, while the secondary winding of the coil *D* is connected with a spark micrometer *F*.

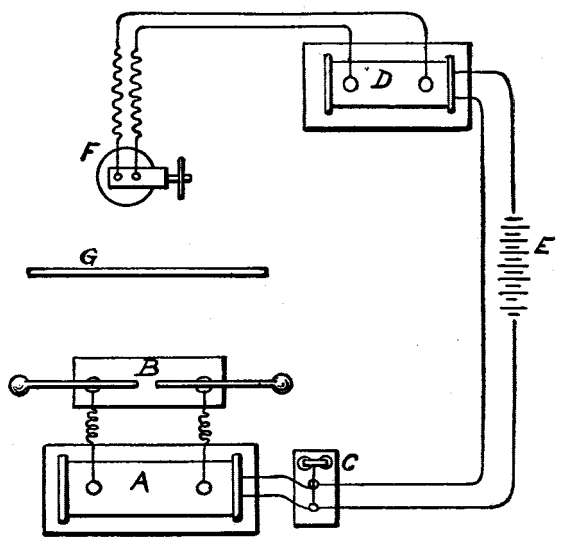

Fig. 1.

The instruments are so arranged that the spark terminals *B* are visible from the position of the spark micrometer. A plate *G*, which may be of glass, mica, metal, or almost any substance available, is now placed in such position that it screens the spark terminals *B* from the light of the spark micrometer, and the spark terminals *B* are so adjusted that the sparks just miss fire, while the sparks of the micrometer are allowed

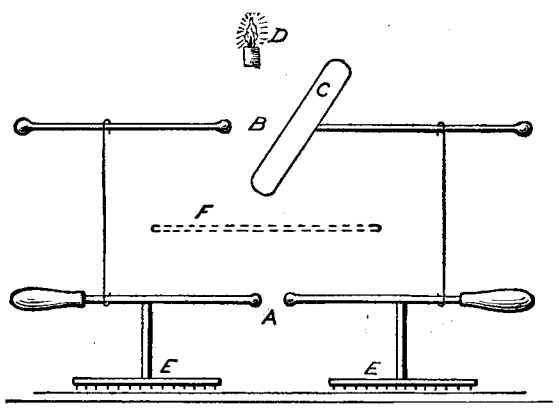

Fig. 2.

to play freely. If, now, the plate *G* be removed, a vigorous and continuous torrent of sparks is set up between the terminals *B*. The spark discharge may be repeatedly stopped and started by inserting and withdrawing the plate *G*. Hertz attributed this phenomenon to the action of ultra-violet light radiating from the spark micrometer and falling upon the terminals *B*, the effect of the illumination being to increase the ease with which the sparks can leap. During the period when the spark terminals are thus freely illuminated by ultra violet light, no Hertzian waves are generated.

Other investigators have discovered that the cathode

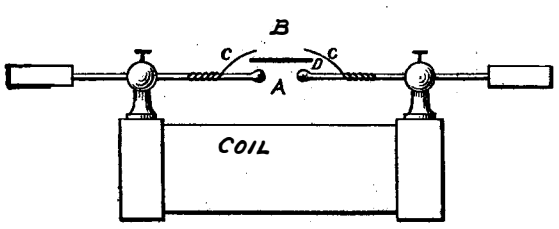

Fig. 3.

terminal is the one chiefly affected by the light.

In Fig. 2 is shown a modification, by Elster and Geitel, of Hertz's experiment. The spark terminals *A* and *B* are connected together, a cathode plate *C* of polished zinc being substituted for one of the knobs. At *D* is a steady source of ultra-violet light, removable at will, and preferably consisting of a burning ribbon of magnesium. *E* and *E* represent the respective anode and cathode conductors of a Holtz static machine. A plate *F* of mica, glass, or other material opaque to ultra-violet rays, is located between *A* and *B*. When light from the source *D* illuminates the zinc cathode *C*, all sparking at *B* ceases, contrary to what might be expected in view of the experiment above described, and a continuous spark discharge is set up at *A*. This experiment is what Lodge calls "a curious inversion of Hertz's fundamental experiment." According to this authority, the ultra-violet rays increase or decrease the leaping distance of the static discharge accordingly as the normal difference of potential may be impulsive, as in a coil, or steady, as in a static machine.

In Fig. 3 is illustrated a modification, by the writer, of Hertz's experiment. A coil is provided with the usual knobs *A*, and with an interrupter. Two pieces *C C* of thin bare wire are mounted upon the knob stems,

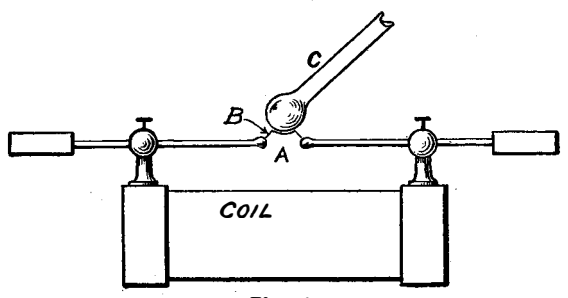

Fig. 4.

and bent into the conformity indicated. The adjustment is such that sparks are normally just able to leap the gap between the terminals *A*, but that no sparks can pass between the points *C C*. The plate *D* now being inserted between *A* and *B*, not only does the spark discharge at *A* cease, as might be expected from Hertz's experiment, but a continuous discharge is now abruptly set up between the points *C C*. Withdrawing the plate *D* causes this discharge to disappear, and the discharge between the knobs *AA* to reappear, so that, in effect, the spark discharge may be shifted back and forth from one spark gap to another by merely inserting and withdrawing the plate. It will be noted that in this experiment there are two spark gaps parallel to each other, and that each gap is exposed to the other when the plate is removed and each is screened from the other when the plate is inserted. The direction and character of the potential of each gap are apparently the same as that of the other. Why, then, does the plate thus apparently affect the two spark gaps unequally?

In Fig. 4 is represented a very simple experiment which, so far as known to the writer, has hitherto escaped observation, and in which the behavior of the spark is quite erratic. The coil shown is thrown into action so that the spark *B* plies steadily between the knobs *A*, and a small spherical body *C* of glass, rubber, or other insulating material is placed in immediate proximity to both knobs, but without touching either. The spark bends outward at its middle and hugs closely against the surface of the insulating body, partaking of its curvature, as indicated in the figure. The spark may thus double or even triple its original length. Moreover, by doing this the spark deserts a beaten path in which the air is heated, rarefied, ionized and permeated with metallic vapor, all tending to increase its conductivity, and cleaves for itself a new path apparently offering a much higher resistance.

Sir William Crookes and Prof. James Dewar on Radium Emanations at Low Temperatures.

Sir William Crookes and Prof. James Dewar have examined the action of extreme cold on radium emanations, and published the results of their work in the Royal Society Proceedings.

The first endeavor was to ascertain whether scintillations produced by radium on a sensitive blende screen were affected by cold. A small screen of blende, with a morsel of radium salt close in front, was sealed in a glass tube. A lens was adjusted in place so that the scintillations could be seen. On dipping the whole into liquid air they grew fainter and soon stopped altogether. Some doubt was felt whether this might not have been caused, (1) by the presence of a liquid; (2) by the screen's losing its sensitiveness; and (3) by the radium's ceasing to emit heavy positive ions. To test this, two tubes were made, in one of which the radium could be cooled without the screen; while in the other the screen could be cooled while the radium salt was at the ordinary temperature. When the radium salt was cooled by liquid air, and the screen was at ordinary temperature, the scintillations were quite as vigorous as at the ordinary temperature, the screen and radium being *in vacuo*. With radium at the ordinary temperature and the screen cooled, in liquid air, it was observed that as the screen cooled the scintillations became fainter and at last could not be seen. On allowing the temperature to rise, the scintillations re-commenced.

The screen with a speck of radium salt in front of it was then sealed in a tube.

Water was put in the other end of the tube, and the tube sealed on the pump. A good exhaustion was kept up and the water boiled away, the vapor being condensed in phosphoric anhydride. The tube was sealed off when a few fine drops of water were still remaining in the tube. The scintillations were well seen in this saturated aqueous vapor. The lower end of the tube was dipped in liquid air, which instantly condensed the aqueous vapor and left a very good vacuum. On now examining the scintillations, they were, if anything, brighter and more vigorous than at first. When liquid hydrogen cooling was used instead of liquid air the action was equally marked, showing that the highest vacuum that can be obtained by the action of cold does not diminish the scintillations.

In the upper part of the tube, away from the radium and screen, two platinum wires were sealed to show the state of the vacuum. The spark passed easily at the ordinary temperature, showing a reddish line of aqueous vapor. When the other end of the tube was in liquid air the spark refused to pass.

It was thought that perhaps the passage of the induction spark might have liberated some occluded hydrogen, so another tube similar to the foregoing was made without the platinum wires. Here also immersion in liquid air, if it had any effect, brightened the scintillations, and on replacing the liquid and cooling by liquid hydrogen no change was observable.

In order to test the activity of radium in rendering air electrically conductive, some radium bromide was sealed up in a glass tube and heated to the highest temperature the glass would stand, during the production of as high a vacuum as the mercurial pump would give. The whole tube was then immersed in liquid hydrogen contained in a vacuum vessel. On bringing the radium in such a vessel into a room in which a charged electroscope was placed, it began to leak when the tube of radium surrounded with liquid hydrogen was some 3 feet away, and was very rapid in its action when a foot away from the electrometer. On immersing the tube containing the liquid hydrogen with submerged radium in another large vessel of liquid air and bringing the combination near the electroscope, the action was the same.

The luminosity of the radium salt in liquid hydrogen was much more marked with the pure compound than had been formerly observed with the diluted mixtures containing large quantities of barium salts.

Prof. Rutherford and Mr. Soddy made the important discovery that a considerable emanation is diffused into gases from solutions of radium salts, which emanation is capable of condensation from the gas mixture at the temperature of liquid air. As it was important to ascertain what was taking place in this respect with the anhydrous radium bromide when isolated in the highest vacuum, an interesting experiment was made.

A glass apparatus was used, consisting of a fine capillary tube, drawn out some 5 or 6 inches in length from an inverted U-tube, the two legs of which were each about 6 inches long, one leg terminating in a bulb. This latter leg was filled with hard-pressed purified asbestos. The radium salt was located in the bottom of the bulb. The whole, after being most carefully heated and exhausted to the limit of the mercurial pump, was sealed off. In the dark, no traces of phosphorescence could be seen in any part of the apparatus, unless from the pieces of radium bromide.

The fine capillary tube was now immersed in liquid air in a large glass, so that distillation might proceed undisturbed for days. After twenty-four hours of this operation, the capillary tube while still covered with liquid air, was examined. A marked phosphorescence was recognizable owing to some condensed emanation. The luminosity became naturally more marked the longer the action was allowed to proceed.

Extermination of Worms and Snails by Electricity.

BY HUGO HALBERGER.

It was largely through an incidental observation that I was led to carry out a series of experiments for the purpose of ridding soils of worms, snails, and like creatures. I conceived the idea of drying by means of electricity a mold which had been constructed directly on the soil. Shortly after turning on the current, I noticed that worms were hurriedly struggling out of a neighboring bed. In crawling from one clod to another they writhed as if in pain. It seemed to me that the effect observed could have been produced only by the electric current. Indeed, the worms seemed to be immensely relieved and to return to their normal condition when the current was interrupted.

After this first observation I carried out a number of experiments. One terminal of an electrical circuit of 110 volts was thrust into the earth, the terminal being comprised of brass rods. The effect produced was even greater than that which I first studied. Within a radius of two meters the worms and snails emerged from the earth and crawled out of the influence of the electrical current. In this manner, by employing several brass rods, I succeeded in driving all the worms out of a bit of land.

The current used is of comparatively feeble strength. The voltage, however, must be correspondingly high. I believe that the remarkable effect of electricity on plants, which has been studied of late years rather narrowly, is to be attributed not so much to any beneficial influence on the plant itself, as to the extermination of the parasites that nest about the roots.

Munich, Germany.

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PROF. SIR WILLIAM CROOKES, F.R.S.

BY THE LONDON CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

"Scientific men are very like paviors; they lay down stones for future generations to walk over, and wear out." Such is the prescient explanation of scientific research and pursuit of a new discovery, expressed by Prof. Sir William Crookes, F.R.S., the eminent British chemist. Science, although it possesses a bewitching glamor to its disciple, is yet a lonely occupation. Great ideas and possibilities of the hitherto unknown, dawn upon the mind of the chemist, only to be followed by years of patient investigation, ceaseless experiments, and repeated failures. When an epoch-making discovery bursts upon the world, not an evanescent thought is bestowed upon the years of protracted labor and intricate calculations that such a discovery has entailed. Sir William Crookes can relate many such experiences. When he discovered the new element thallium, he promptly set to work among other numerous experiments to ascertain its atomic weight—203.642. The figures were worked out as far as the first decimal point with comparative ease, but to determine the second decimal figure involved no less than two years of patient labor.

Sir William Crookes is a born scientist. He played with chemistry in his infancy, practised it during his youth—much to the discomfiture of his parents, whose goods and chattels suffered from the effects of his experiments—and has developed it ever since. He is now in his seventy-first year, having been born in 1832. At sixteen years of age he entered the Royal College of Chemistry as a pupil of the famous Dr. Hoffmann, and acquitted himself with such distinction that two years later he was appointed Hoffmann's assistant. In 1854 he obtained the much-coveted post of Superintendent of the Royal Meteorological Department of the Radcliffe College of Oxford, which post he subsequently relinquished in order to devote his entire energies to the pursuit of chemistry.

Although his work has been rigorously scientific, Sir William Crookes is gifted with a poetic imagination that has often enabled him to set forth tellingly in his papers the results he has attained. Once he has embarked upon a project, he knows no turning back. "To stop short in any research that bids fair to widen the gates of knowledge, to recoil from fear of difficulty or adverse criticism is," he considers, "to bring reproach upon science." He goes straight on, feeling his way with the utmost caution, exploring up and down, right and left, inch by inch, following his reason wheresoever it may lead him, even although occasionally it may prove a veritable will o' the wisp. It was this dogged perseverance which resulted in his discovery of thallium and its remarkable properties. The experiments with this new element were continued for a period of about eleven years, from 1862 to 1873, and throughout the whole of this time the study of the occurrence, distribution, and reaction of this substance was his paramount work.

Prof. Crookes's discovery of thallium, like Dr. Roentgen's discovery of the X-rays, was to a very great extent the result of an accident. He was engaged in the examination, by the spectroscope, of the residue which results from the manufacture of sulphuric acid, when his attention was attracted by a bright emerald-green line which asserted itself. This line had never been noticed before, and he consequently followed up its appearance, with the result that he succeeded in isolating a new metal which he called thallium. The first piece of this new element was placed on view at the Great Exhibition in London of 1861, and commanded universal attention. During the next eight years he carried out minute investigations of the many properties of this substance. It was in the course of his experiments to determine its atomic weight, during which, in order to obtain accuracy, he weighed it in a vacuum, that he discovered that even under these conditions the balance behaved in a most irregular manner. The metal appeared to be heavier when cold than when in a heated condition, and this phenomenon he explained as an "expulsion from radiation." He showed that in a vessel from which the air has been extracted, a body has a tendency to repel itself from another body which has a greater heat than itself. It was this observation of the anomalous behavior of thallium that led to his invention of the radiometer, which by the way he regarded as an apparatus for the direct transformation of light into heat, but which was subsequently perceived to be dependent upon thermal action.

He next devoted his attention to the discharges of electricity through highly rarefied gases, and to the development of the theory he had formed in the course of his previous experiments with thallium, of the existence of a "fourth state of matter."

The name of Crookes will forever be associated with his remarkable discoveries in connection with radiant matter and his evolution of the Genesis of Elements. The results of his researches in highly rarefied tubes caused him to assume the existence of matter in ultra-gaseous form, to which he applied the term of radiant matter. He explained the novel phenomena of phosphorescence, trajectory shadows, mechanical action, magnetization, and intense heat, possessed by matter in ultra-gaseous state. It was a remarkable discovery that stormed the scientific world, for it was of enormous range, as the discoverer conclusively proved by demonstrating that while some radiant matter was as stable as a chair, other forms were of the character of radiant energy. It was the fringe where matter and force appeared to merge into each other.

At first Prof. Crookes's thesis was regarded with skepticism by the scientific world, until the elaborate and numerous experiments of the discoverer proved unassailably convincing in the natural progress of events. But the times have changed, and we have changed with them since Crookes's discovery was first announced. What he originally termed radiant matter has developed into electrons—the separate units of electricity, which is as atomic as matter. Dr. Johnstone Stoney by his discovery of electrons not only established Prof. Crookes's earlier discovery, but successfully elucidated many problems which had previously defied solution, for a chemical ion consists of a material nucleus or atom of matter, which constitutes the greater part of the mass, and a few electrons or atoms of electricity. He demonstrated that all liberated electrons do not pass off in the form of gas, but act more in the form of a mist, are mobile, and are carried to and fro in currents of air, finally settling on the walls of the settling vessel if left undisturbed.

The mass of an electron, according to J. J. Thomson, is calculated at 1/700 part of a hydrogen atom, and as these masses start from the negative pole in a vacuum tube with a velocity of about one-half of that of light, naturally their heating, phosphorescent, and mechanical power is tremendous.

The course of time has proved that Prof. Crookes's thesis of 1879 was no wild chimera of the laboratory, but an indisputable fact which opened up a fresh untrodden field in scientific investigation. The existence of matter in an ultra-gaseous state, the existence of material particles smaller than atoms, the existence of electrons, the emanations from uranium, and the dissociation of the elements have now all been proved to be one homogeneous theory, by the remarkable discovery of radium and the experiments with this new element by M. and Mme. Curie, so that what was twenty-five years ago regarded as Prof. Crookes's dream, has at last been realized.

With regard to Prof. Crookes's researches concerning the Genesis of Elements, it is difficult to estimate adequately the value of his investigations in this direction to science. It was in 1883 that he commenced operations in his work which was attended with such momentous success. It was a laborious task, this inquiry of the nature and construction of the rarer earths, but by dint of repeated chemical fractionations he succeeded in dividing yttrium into distinct portions, which yielded different spectra when exposed in a high vacuum to the spark from an induction coil. At first these phenomena were regarded as due to the removal of impurities in the metal, but Prof. Crookes conclusively established his claim that they were the result of the actual splitting up of the molecule of yttrium into its fundamental constituents, and he provisionally concluded that the so-called simple bodies are in reality compound molecules. This discovery led him to advance the supposition that all the elements are derived by a process of evolution from the primordial matter or "protyle" as he called it.

In his presidential address to the British Association in 1898 he announced the discovery of yet another member of the rarer earths—monium or victorium. The spectroscopic examination of this showed the spectrum crossed by an isolated group of lines high up in the ultra-violet end, and the existence of which could be detected only upon the photographic sensitive negative.

The investigations of this eminent scientist have not been confined to a selected few of the many fields of chemical research, but to all its ramifications, with the result that he has bestowed incalculable benefits upon various manufactures. He discovered the sodium amalgamation process of separating gold and silver from their respective ores; he carried out numerous experiments with M. Moissan's method of the manufacture of diamonds, by which our very limited knowledge of the nature of this substance has been considerably extended; he is deeply interested in dyeing and calico printing, the manufacture of beet sugar, and the derivatives of anthracene, while he is one of the greatest authorities on sewage and artificial fertilizers. In 1871 he accompanied the scientific expedition to Oran; and in 1866, when the cattle plague caused such widespread alarm in Great Britain, he was appointed by the English government to report upon the application of disinfectants for arresting the scourge. Perhaps his most famous invention familiar to the lay mind is the Crookes tube, by means of which Prof. Roentgen was able to make his famous discovery of the phenomena of the X-rays.

Owing to his immense knowledge, he is naturally associated with the leading learned and scientific societies of Great Britain, the presidential chair of many of which he has occupied at one time or another. He has also made many valuable contributions to scientific literature. His best-known publications comprise: "Select Methods in Chemical Analysis;" "Manufacture of Beet-root Sugar in England;" "Handbook of Dyeing and Calico Printing;" "Dyeing and Tissue Printing;" "The Profitable Disposal of Sewage;" and "The Wheat Problem." In 1859 he founded the Chemical News, and in 1864 he became editor of the Quarterly Journal of Science.

He has received many distinguished awards in recognition of his many valuable contributions to science. In 1880 he received from the French Académie des Sciences their gold medal and a purse of 3,000 francs; in 1885 the Davy medal of the Royal Society of Great Britain was bestowed upon him. He is a Royal medallist, and his crowning recognition came in 1897, when he was knighted for his achievements by the late Queen Victoria.

Prof. Crookes is also deeply interested in psychical research and its attendant phenomena, by which he is endeavoring to effect some conjunction between psychical and physical waves. Marconi has forcibly demonstrated the presence and possibilities of ether waves, and this eminent chemist is attempting to establish the existence of brain waves. We hear a good deal about telepathy, by which one person can receive intelligence from another human being without speech. But what is a brain wave, or in more explicit words, what is thought? Prof. Crookes maintains that there are rays of perhaps 9,223,052,036,854,775,808 pulsations per second, which are capable of penetrating the most dense mediums without suffering any diminution of intensity, and capable of passing through unrefracted and unreflected light, finding a center in the brain in much the same manner in which sound vibrations are received.

In the course of his presidential address to the British Association in 1898, Prof. Crookes raised the alarming theory that in the near future the world would be faced with starvation, owing to the wheat supply being insufficient to meet the exigencies of the population. He drew attention to the small harvest of wheat at present received per acre of ground and the limited area of wheat-growing soil. The present receipt per acre is 12.7 bushels, and he pointed out that it might be increased by means of a moderate dressing of chemical manure. "Starvation may be averted through the laboratory," he explained, and his solution of the difficulty was to draw upon the inexhaustible quantities of nitrogen present in the atmosphere, and render it practicable to utilize it for fertilization. The artificial production of nitrate is within view, and by its assistance it will be possible to obtain as much as thirty bushels of wheat per acre.

The charm of Prof. Crookes's character is his honest, frank, and simple manner. He believes in the truth, and is kindly and courteous to all those who approach him. His laboratory is his haven, and therein he passes the greater part of his time among his retorts, spectrographs, test-tubes, and numerous other scientific appliances, and what he regards as much more important, his extensive library of works upon every conceivable branch of science.

An Exposition of Child Life.

A curious international exposition is to be held next fall in the Imperial Palace of St. Petersburg. The undertaking is called "The Child's World." According to the Russian Consul-General at New York, there will be a complete picture of child life from birth to school days—nourishment, dress, instruction, physical and moral education, and in fact all the surroundings of the early years of life.

The exhibits have been divided into five sections, as follows: Section 1 on scientific teaching will show the aids in teaching children by means of manuals, books, maps, and pictures. It will also show exhibits of the establishments for child education in all parts of the world.

Section 2 will be devoted to that which pertains to the physical development of children. In this section will be considered the care of the new-born, hygiene before school age and of school children, nourishment, children's playgrounds, and the like.

The third section is the industrial one, where there will be exhibits in nursery surroundings, furniture, lighting, heating, ventilation, beds and bedding, and children's clothing. In this section will be shown also the toys and games of children all over the world.

Section 4 will be the art section, in which child life in pictures, by artists of all schools, will be shown in oil, water colors, pencil drawings, and all methods of reproductive art.

Section 5 is the historic-ethnographical section, where there will be illustrations of historical events from the lives of child heroes, discoveries and inventions made by children, works and compositions by young artists and composers, and ethnological peculiarities in the lives of children of different nations.

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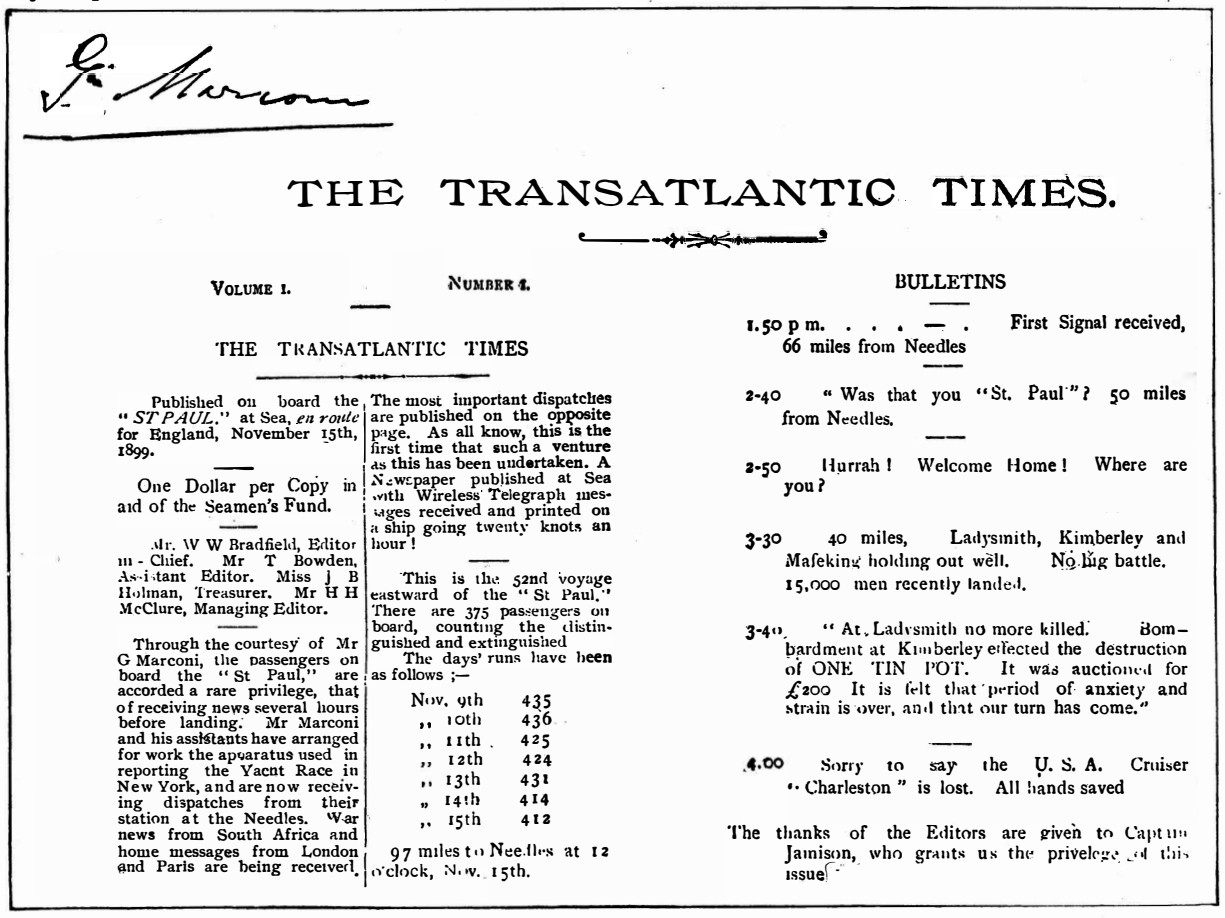
MARCONI WIRELESS TELEGRAPH RELICS.

Commercial wireless telegraphy may hardly be said as yet to have a history. Many years from now, however, when the story of its rise will be written, the historian will find it necessary to present no small account of the first messages that were sent across the Atlantic, as well as of the practical uses to which wireless telegraphy was applied in the early days of its development. The story would not be complete without some account of the first wireless newspaper published on shipboard, and without reproductions of the first messages transmitted across the Atlantic waters.

Not the least interesting of the records which will be carefully preserved for this future historian is a copy of the first newspaper ever published aboard ship, containing wireless news sent from shore. Through the courtesy of Messrs. Munroe & Munroe, of New York, Mr. Marconi's representatives in this country, we are enabled to present a facsimile reproduction of this interesting sheet. The paper was published on board the "St. Paul" of the American Line, at sea, *en route* for England, on November 15, 1899. It bears Mr. Marconi's signature.



G. Marconi

THE TRANSATLANTIC TIMES.

VOLUME 1. NUMBER 4.

THE TRANSATLANTIC TIMES

Published on board the "ST PAUL," at Sea, *en route* for England, November 15th, 1899.

One Dollar per Copy in aid of the Seamen's Fund.

Mr. W W Bradfield, Editor in-Chief. Mr T Bowden, Assistant Editor. Miss J B Holman, Treasurer. Mr H H McClure, Managing Editor.

Through the courtesy of Mr G Marconi, the passengers on board the "St Paul," are accorded a rare privilege, that of receiving news several hours before landing. Mr Marconi and his assistants have arranged for work the apparatus used in reporting the Yacht Race in New York, and are now receiving dispatches from their station at the Needles. War news from South Africa and home messages from London and Paris are being received.

The most important dispatches are published on the opposite page. As all know, this is the first time that such a venture as this has been undertaken. A Newspaper published at Sea with Wireless Telegraph messages received and printed on a ship going twenty knots an hour!

This is the 52nd voyage eastward of the "St Paul." There are 375 passengers on board, counting the distinguished and extinguished

The days' runs have been as follows ;—

Nov. 9th	435
,, 10th	436
,, 11th	425
,, 12th	424
,, 13th	431
,, 14th	414
,, 15th	412

97 miles to Needles at 12 o'clock, Nov. 15th.

BULLETINS

1.50 p m. . . . — . First Signal received, 66 miles from Needles

2-40 "Was that you "St. Paul"? 50 miles from Needles.

2-50 Hurrah! Welcome Home! Where are you?

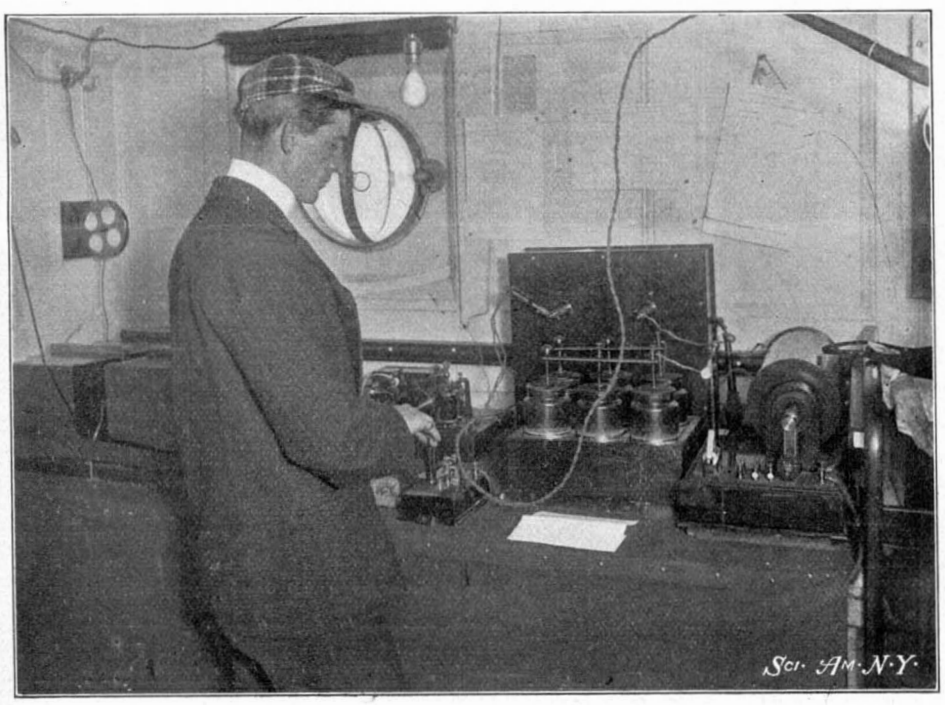
3-30 40 miles, Ladysmith, Kimberley and Mafeking holding out well. No big battle. 15,000 men recently landed.

3-40 "At Ladysmith no more killed. Bombardment at Kimberley effected the destruction of ONE TIN POT. It was auctioned for £200 It is felt that period of anxiety and strain is over, and that our turn has come."

4.00 Sorry to say the U. S. A. Cruiser "Charleston" is lost. All hands saved

The thanks of the Editors are given to Captain Jamison, who grants us the privelege of this issue

FACSIMILE OF THE FIRST NEWSPAPER EVER PUBLISHED ABOARD SHIP CONTAINING WIRELESS NEWS FROM SHORE. MARCONI'S SIGNATURE AUTHENTICATES THE ORIGINAL.



THE MARCONI APPARATUS WITH WHICH THE NEWS FOR THE FIRST WIRELESS PAPER WAS RECEIVED.

THE HAND PRESS ON WHICH THE FIRST WIRELESS NEWSPAPER EVER ISSUED ON SHIPBOARD WAS PRINTED.

Messages one thousand five hundred and fifty five. Test letter two thousand and ninety nine. on tape receiver. Marconi

FACSIMILE OF MARCONI'S ORIGINAL RECORD OF THE FIRST TRANSATLANTIC MESSAGES RECEIVED ON BOARD THE "PHILADELPHIA."

For Americans, the most important step in the development of wireless telegraphy was the transmission from Cape Cod of President Roosevelt's greetings to Edward VII. That message, written in the President's own hand, has been carefully preserved. Mr. Marconi's transcript is here reproduced. Other wireless curios could be pictured, almost without number. Those that have been shown, however, may be considered of most historical value.

His Majesty King Edward Seventh. London

(By Marconi's Transatlantic Wireless Telegraph)

In taking advantage of the wonderful triumph scientific research and ingenuity which has been achieved in perfecting a system of Wireless Telegraphy I extend on behalf of the American people most cordial greetings and good wishes to you and to all the people of the British Empire.

Theodore Roosevelt

White House Washington 17

MR. MARCONI'S TRANSCRIPT OF THE MESSAGE SENT BY PRESIDENT ROOSEVELT TO KING EDWARD VII.

The Mud Springs of Mendocino.

The mud springs of Mendocino County, California, are located sixteen miles northeast of Westport on the coast. They occupy a space of 25 acres at an altitude of 1,400 feet above the sea, and number thirty or forty, with vents ranging from three feet in diameter to three inches. The water which bubbles out of the orifices holds in solution a large percentage of bicarbonate of soda, which solidifies as it spreads over the surrounding land, leaving the surface as white as though covered by snow. Few persons visit these springs, on account of their inaccessibility, but, with the extension of the railroad from San Francisco, the place will certainly become a popular resort. The water is ice cold, but those who venture to take a mud bath profess to find great relief from their maladies.

In the vicinity there are numberless mineral springs of great volume and potency. A remarkable fact relating to the mud springs is that every earthquake shock in the State, no matter how distant it may be, can be detected by action of the springs, for either the flow of water is increased or the soil which surrounds them quakes. It is said also that at regular periods the water of the springs ebbs and rises like the tide.

It is said that work on the mono-rail high-speed electric railway from Liverpool to Manchester will probably be begun this summer. The trains on the new road are to run at the rate of 110 miles an hour, and are expected to reduce the time from Liverpool to Manchester from 40 minutes to 20 minutes.

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MOTOR BOAT RACES IN IRELAND FOR THE HARMSWORTH CUP.

BY OUR SPECIAL CORRESPONDENT IN IRELAND.

The first International Motor Boat Race for the Harmsworth cup took place in Queenstown Harbor on Saturday, July 11.

The trophy is offered by Mr. Alfred Harmsworth, proprietor of the London Daily Mail, for any type of motor boat not exceeding 40 feet over all, fitted with any form of power and with no limit as to the amount thereof; it is essential that the man who steers the boat shall be a member of a recognized club, just as in the contest for the Gordon Bennett cup.

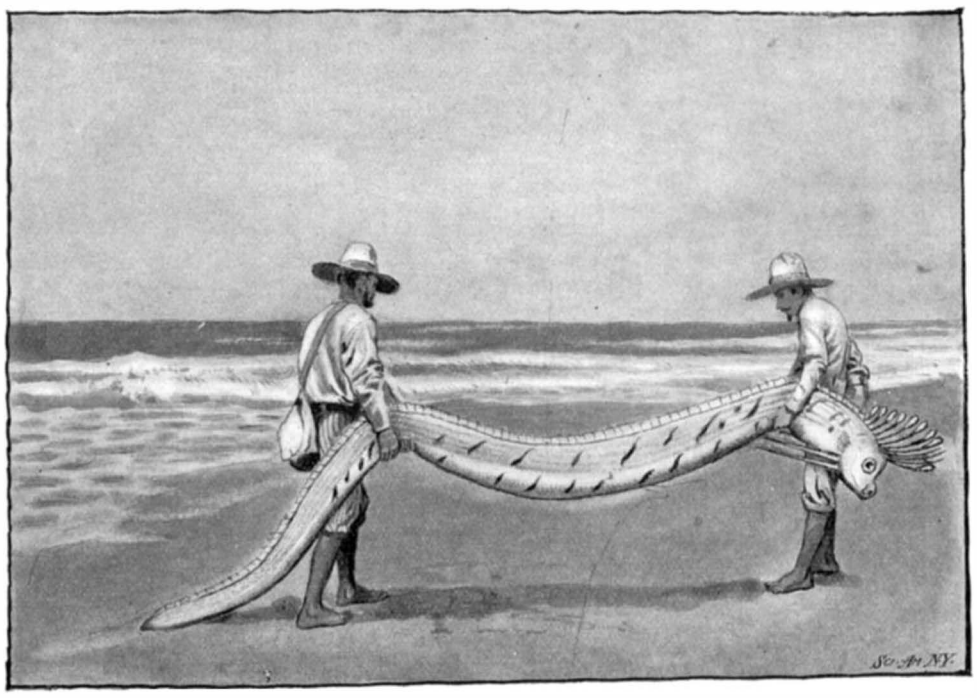
The more important conditions imposed by Mr. Harmsworth are the following:

The cup shall be for international competition, and the trustees of the same shall be the Automobile Club of Great Britain and Ireland.

The cup shall be competed for annually under the racing rules for the time being of the Marine Motor Association of the United Kingdom.

There shall be not more than three vessels representing each country.

Each competing vessel shall be constructed wholly and in every particular in the country which it represents.



THE RIBBON FISH, OFTEN MISTAKEN FOR THE MYTHICAL "SEA SERPENT."

No limitation shall be placed on the form or description of motive power, provided that the motive power is wholly mechanical.

Each vessel shall carry not less and not more than two hands, of whom the helmsman shall be a member of the competing club, and both hands shall be natives or naturalized subjects of the country which they represent. The entries were:

1. Mr. S. F. Edge's launch, 40 feet in length, driven by a 75 horse power, four-cylinder, Napier gasoline motor attached to a two-bladed propeller. The size of the cylinders of the motor used are 6½ inches bore by 7½ inches stroke; its normal speed is 800 R. P. M.; and jump spark ignition is employed.

2. Mr. F. Beadle's launch, 30 feet in length, constructed of cedar wood and driven by a 50 horse power, eight-cylinder, gasoline motor, with two two-bladed propellers on the same shaft.

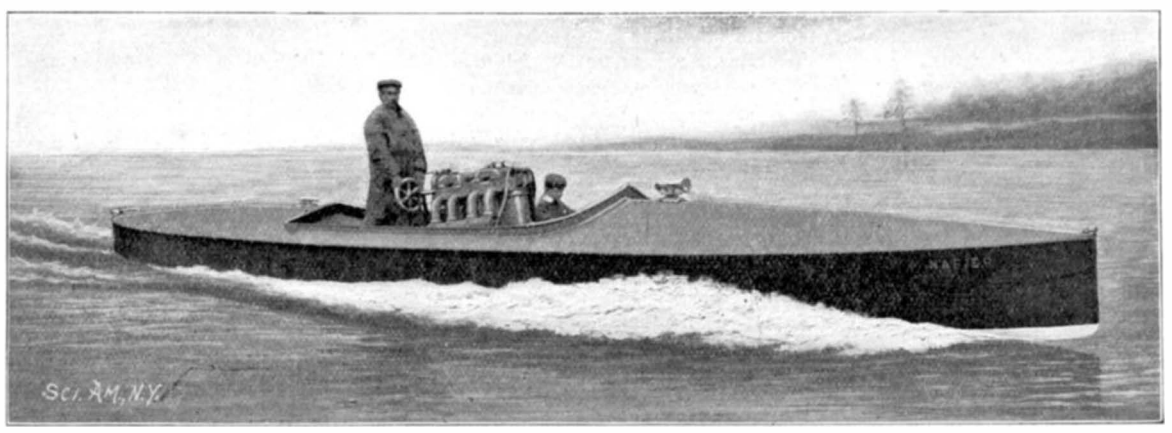
3. Mr. J. E. Thornycroft's launch, 30 feet long, driven by a 20 horse power, four-cylinder, Thornycroft gasoline motor connected to one 18-inch three-bladed propeller.

The first winner was Mr. S. F. Edge's Napier racing launch, a photograph of which is here shown.

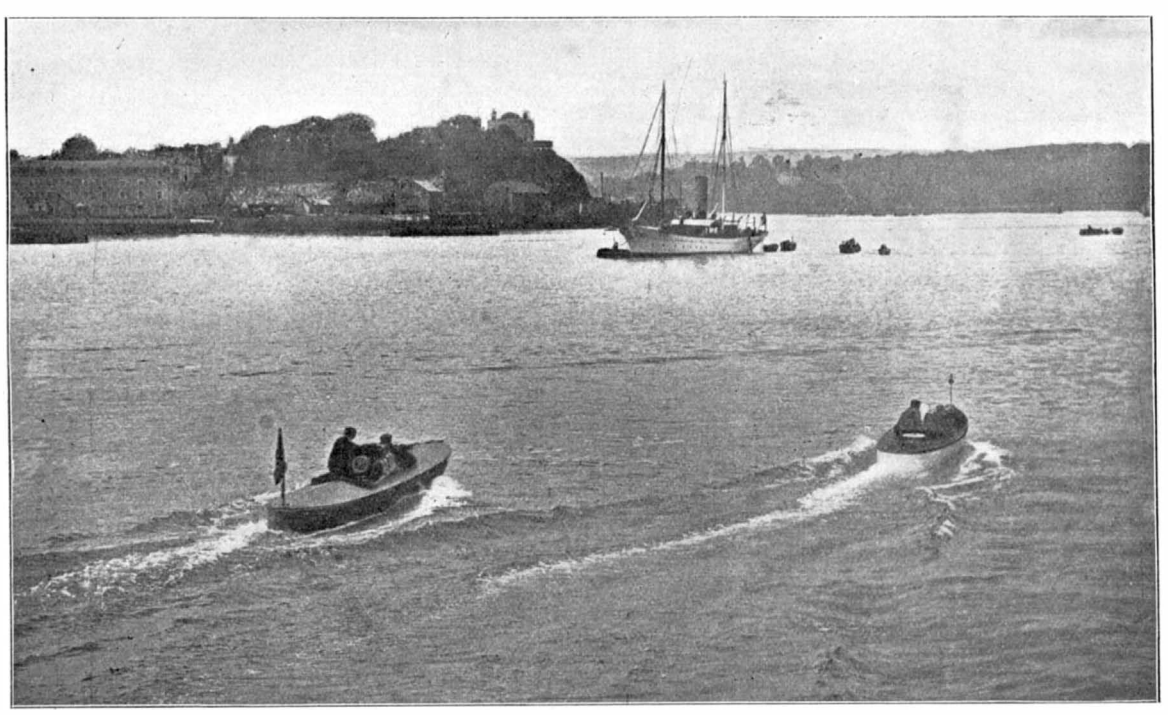
The course extended from the quarters of the Royal Cork Yacht Club, Queenstown, up the River Lee to Cork, a distance of 8½ miles. In the draw, Thornycroft's boat got a bye. Edge, who covered the distance in 24 min., 44 sec., beat Beadle, who took 27 min., 44 2-5 sec. Thornycroft was then pitted against Edge, the boats returning to Queenstown so as to travel to Cork over the same course. Edge was an easy victor, beating Thornycroft by 5 min., 8 3-5 sec. The winner's time was 26 min., 6 sec. A handicap race for the Yachtsman's cup (given by the proprietor of a yachting newspaper) was next contested, the entrants being the same as in the previous race. Edge was scratch, Beadle had a handicap of 6 min., 55 sec., and Thornycroft 11 min., 50 sec. The last-named won in 33 min., 51 1-5 sec., Beadle's time being 33:12 3-5, and Edge's 27:9 1-5.

The 40-foot Napier launch entered for the race was designed by Mr. Linton Hope and built by Mr. S. F. Edge.

The hull is built of 20 B. W. G. steel, and the frames and floors of light angle and plate, while two longitudinal girders run fore and aft to carry the motor and separate thrust bearings. There is no deck to the craft, but merely a covering of canvas stretched tightly over the hull. She has a beam of 5 feet, molded depth of 2 feet, and an over-all length of 40 feet; her total displacement is 1½ tons.



THE NAPIER LAUNCH OF S. F. EDGE, ESQ.



THE FIRST RACE FOR THE HARMSWORTH CUP IN QUEENSTOWN HARBOR.
Mr. Edge's Boat Appears on the Left; Mr. Beadle's on the Right.

H. Stassano has collected measurements of as many lines as possible which have been observed by various physicists, and compared them with Liveing and Dewar's measurements of the spectrum of the most volatile gases of the atmosphere. He has also done the same for the chromospheric and prominence spectra of the sun. He comes to the conclusion that the aurora consists of helium, hydrogen, neon, and argon. Many of Liveing's and Dewar's lines he selects are yet unassigned.

THE RIBBON FISH AND THE SEA SERPENT.

BY CHARLES F. HOLDER.

One of the most interesting questions relating to the sea and its inhabitants, and appealing strongly to popular fancy, is that of the sea serpent, which, literally, will never down. Hardly a month passes but some strange creature is seen by the men who go down to the sea in ships; everything that is seen is reported as a sea serpent. It is inconceivable that these people are always mistaken, or that a large percentage are plain prevaricators, or that a still larger percentage are practical jokers. In a word, something is observed out of the common, reported as a "sea serpent." Some see a giant squid, fifty, perhaps seventy feet in length, darting along the surface, tail first, the latter out of water at times. I have seen a wounded squid, two feet in length, moving in this way, occasionally projecting its tail a few inches out of the water; its tentacles forming small "undulations" behind, and from a distance of thirty feet presenting a marvelous resemblance to a snake or serpent. A large squid could easily simulate a sea serpent. Some observers see lines of porpoises; others, whales in a line or seaweed, or birds, and the unskilled observer firmly believes he sees something strange and uncanny, which he assumes to be the sea serpent.

That there is a literal sea serpent is not believed by scientists, but that there may be some large and unknown, or uncaught fish, long, slender, and serpent-like, inhabiting the ocean, attaining a large size, is not beyond possibility. An animal that doubtless has figured as a sea serpent is shown in the accompanying photograph. Specimens sixty feet in length have been observed, and if this fish should attain a length of seventy or eighty feet and be seen rushing along at the surface, one could hardly picture a more remarkable "sea serpent." The subject of the illustration is an oar or ribbon fish (*Regalicus*), and was, possibly, the largest ever taken in American waters. It came inshore at Newport, on the Santa Catalina Channel, opposite the island of that name. An Indian was riding up the beach when he observed a large fish in the surf, and after considerable difficulty hauled out what he supposed to be a sea serpent high on the sands. Not being aware of the value of the specimen, he stripped off some of its beautiful "plumes," or dorsal fins, and carried them to the town. Crowds soon went to the shore to see the monster, which was duly reported in the daily papers as thirty feet in length and weighing one thousand pounds. When the excitement had subsided, Mr. Horatio J. Forgy an attorney of Santa Aña, measured the strange fish. The length was found to be twenty-one feet; its weight was estimated at between five and six hundred pounds, but judging by the photograph, and an "angler's guess," three hundred pounds would seem ample, though the writer has no desire to trim the wonders of this remarkable fish. The creature was, fortunately, photographed by Mr. G. T. Peabody, and probably this is the only photograph extant of a large specimen of *Regalicus*. From this photograph the accompanying illustration was made. Unfortunately, no one present realized the importance to science of saving the fish. It is estimated that hundreds of persons saw the remains, and none recognized it as a ribbon fish.

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The ribbon-fish is one of the most beautiful and interesting of its kind, and up to this time was generally supposed to have been unknown in American waters. The writer has seen several dead specimens, and one live specimen at Santa Catalina Island, but all were very small. Doubtless such come inshore after storms in winter, though the specimens observed were found in summer. The large one taken at Newport came ashore in February after a severe storm, which strewed the beach with numbers of fish strange to the inhabitants, including several small ribbon-fishes.

The ribbon-fish is a deep-sea form. As it attains a large size, it doubtless has been seen and chronicled as a sea serpent. Its appearance is remarkable. The fish is literally like a ribbon. Those handled by the writer were beautiful diaphanous creatures, clear and jellylike. The color was silver, tinted with blue and splashed with black tigerlike stripes. The forehead is very high, and from the top of the head rise a series of dorsal spines, eight in number (*Regalicus Russelli*), a vivid coral in color, and when erect resemble pompons, or a red mane, giving the fish a most fantastic appearance. The fin continues the entire length of the body, and just below the pectoral fins extend two long rays which represent the ventral fins. The head is long and oblong; the teeth absent; the body ribbonlike, that is, flat, gradually tapering to the tail.

The history of this rare fish is extremely interesting. While fairly well known in other localities, it was not reported in American waters until the writer observed the Santa Catalina specimens and wrote to Dr. G. Brown Goode regarding them several years ago; other finds have been so rare that it is believed that all are known. Goode and Bean say: "Within the past one hundred and fifty years individuals have visited the shores of Norway, Finmark, the Faroe Islands, Scotland, Ireland, England, France, Mediterranean, Bermuda, the Cape of Good Hope, Hindostan, and New Zealand." Gunther reports forty-four, seen by naturalists, and doubtless others have been observed and not reported. The exact size to which *Regalicus* attains is not known, but specimens ranging up to sixty feet in length have been examined, and may be considered, so far as known, giants of the tribe. Goode and Bean, referring to a specimen twenty feet in length, state, "and it is more than probable that they grow much larger, and that many of the creatures popularly identified with the sea serpent are only large animals of this type." In 1860 an individual seventeen feet in length went ashore in Hungry Bay, Bermuda. The giant of the tribe is chronicled by Dr. Andrew Wilson, of the University of Glasgow, who states that Lord Norbury engaged the smack "Sovereign," Capt. Baillie, of Hull, to trawl for him in the Frith of Forth, and among other fishes they one day hauled up an oar-fish, which when stretched upon the deck of the smack, which was of 40-ton burden, was larger than the vessel, or sixty feet in length; and some of the men stated that they had seen much larger specimens. Lord Norbury did not realize the value of the catch, and as it was an interference to the work, he ordered the men to throw it over. This fish at the surface, with its waving red plumes, would fully have realized the ideal "sea serpent."

The royal yacht "Astern" once reported having seen a remarkable sea monster near Sicily, which in all probability was a ribbon-fish. The writer has never doubted that some remarkably large animal had been observed in Massachusetts Bay after receiving the following letter from one of the most intelligent men in Essex County, and has thought this "sea serpent" a *Regalicus* approximating the one observed by Lord Norbury. The letter is as follows:

"Lynn, Mass., June 26, 1881.

"Mr. C. F. Holder:

"Dear Sir: Yours of the 24th instant came duly to hand, and, in reply to that part of it relating to the account given by myself of a strange fish, serpent, or some marine animal called a sea serpent, I have to say that I saw him in a pleasant, calm summer morning of August, 1819, from Long Beach, now Nahant.

"At this time he was about a quarter of a mile away; but the water was so smooth that I could plainly see his head and the motion of his body, but not distinctly enough to give a good description of him. Later in the day I saw him again off 'Red Rock.' He then passed along one hundred feet from where I stood, with head about two feet out of the water, and his speed was about the ordinary of a common steamer. What I saw of his length was from fifty to sixty feet. It was very difficult to count the bunches, or humps (not fins), upon his back, as by the undulating motion they did not all appear at once. This accounts in part for the varied descriptions given of him by different parties. His appearance on the surface of the water was occasional, and but for a short time. The color of the skin was dark, differing but little from the water or the back of any common fish. This is the best description I can give of him from my own observation. And I saw the monster just as truly, although not quite so clearly, as I ever saw anything.

"This matter has been treated by many as a hoax, fish story, or a seaside phenomenon, to bring trade and profit to the watering-places; but notwithstanding all this, there is no doubt in my mind that some kind of an uncommon and strange rover in the form of a snake or serpent, called an ichthyosaurus, plesiosaurus, or some other long-named marine animal, has been seen by hundreds of men and boys in our own, if not in other waters. And five persons besides myself—Amos Lawrence, Samuel Cabot, and James Prince, of Boston, Benjamin F. Newhall, of Saugus, and John Marston, of Swampscott—bore public testimony of seeing him at the time. Yours truly,

"Nathan D. Chase."

A Forty-Thousand Volt Power Transmission.

BY EMILE GUARINI.

The Oerlikon Construction Works, at Oerlikon, near Zurich, Switzerland, have recently received an order which commands attention as much on account of its importance as because of its special character. The order in question rests upon the utilization of the water power of the River Caffare and the transformation of that power into electric energy.

The Caffare River rises in the Alps on the border between Italy and the Tyrol, and falls into the Chiese River. The installation is calculated to deliver a total of 15,000 horse power to turbines disposed in two generating stations.

The upper station, the building of which will be undertaken at some later period, will furnish 5,000 horse power, while the lower station, which is to be situated upon Italian territory, near the town of Bagolino, will be commenced within a few days. It is expected to deliver 10,000 horse power. When the two stations are finished, they will work in parallel, and the tension at the terminals of the three-phase current generators will be 9,000 volts, with a frequency of 42. This tension will be raised by transformers to 40,000 volts for transmission over the main line. The current, at this high tension, will be carried to Brescia, about 25 miles distant, and there a part will be used to feed the reducing transformers, a part for electric lighting in the province of Brescia, and the rest will be sold to the large electro-chemical establishments there. At the lower hydro-electric station the estimated flow of water is about 876 gallons a second, which, with a fall of 833 feet, is calcualted to deliver 10,160 effective horse power at the turbines.

To lead this water to the penstocks it will be necessary to build a canal 14,760 feet long, which will pass through four tunnels, one of which will measure 7,544 feet in length.

Five groups or power units will be installed at the lower hydro-electric station, each having a capacity of 2,500 horse power. Each unit is to consist of a turbine, making 350 revolutions a minute and connected direct with a three-phase current dynamo. At a convenient spot in the main building, near the above-mentioned units, will be installed two smaller turbines of 160 horse power, each making 600 revolutions a minute; their function will be to run the exciters, one each, to which they will be also directly connected. Since one exciter is sufficient to energize four of the power units, the plant will thus be provided with one large generator and one exciter as a reserve in case of accident.

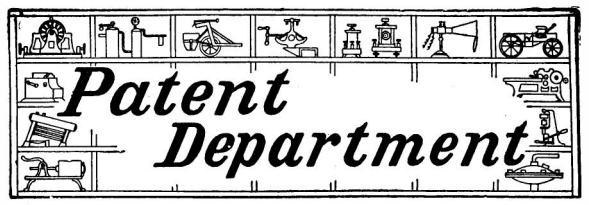
Five transformers each will also be provided to raise the tension to 40,000 volts. At the point of consumption this current must again be reduced by five other transformers to a tension suitable for distribution.

This power plant is the more interesting since it is the first plant of the kind in Europe to make use of a tension of 40,000 volts as well as of transformers of a capacity exceeding 2,000 kilowatts.

The Current Supplement.

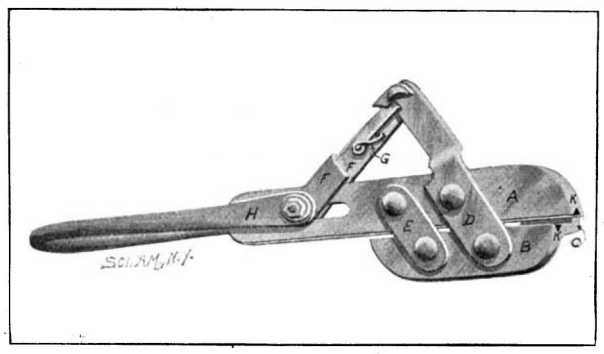
The current Supplement, No. 1440, opens with an illustrated article by Emile Guarini on the power plant of the Metropolitan Street Railway of Paris. Dr. Franz Meyer reviews the history and commercial development of the Schroeder contact process of sulphuric acid manufacture. Of technical interest are articles on "An Unrecorded Property of Clay," "The Coloring of Metals," and "The Preservation of Wood." The English correspondent of the Scientific American describes the Hattersley automatic loom. In a very full and well-illustrated article, the magnetic observatories of the United States Coast and Geodetic Survey are excellently described. Prof. J. Reynolds Green discusses vegetable physiology. An article on impurities and purification of acetylene will probably be found of value.

The large fleet of United States sailing vessels which hitherto has been employed in the petroleum oil deep sea trade has recently almost completely been driven out of the field by the subsidized French sailing craft.



WIRE GRIP FOR LINEMEN.

Our illustration shows a simple form of wire grip for the use of linemen in stringing electric wires. Provision is made, in connection with the grip, of a simple device for holding a length of wire while twisting its ends around the wire held in the grip. The grip comprises a fixed jaw *A* and a movable jaw *B*. The jaw *B* is movable at all times in parallelism with the fixed jaw by reason of its double pivotal connection therewith through the lever *B* and the link *E*. To the outer end of the lever *B* are pivoted the links *F* which extend to a bolt movable in a slot formed in the outer end of the fixed jaw. Secured to this bolt is a loop *H* to which a draw-rope or strap may be attached. A spring *G* arranged between the

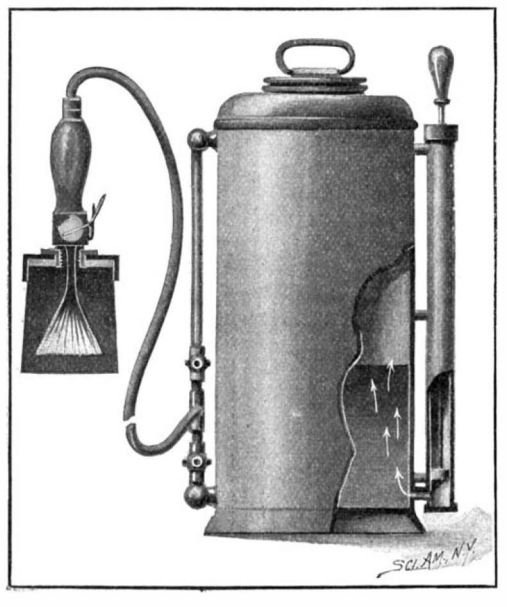


WIRE GRIP FOR LINEMEN.

links *F*, and engaging the upper end of the lever *D*, serves to normally close the jaws sufficiently tight to frictionally engage a wire which is held in the V-shaped slots *K*. When, however, strain is put upon the device the jaws will be drawn tightly together through the medium of the lever and the links connecting with the loop *H*. On one side of the jaw *B* is a keeper *C* for the wire which is designed to have its end turned around a wire engaged by the jaws. In operation, the main wire is clamped between the jaws and then the wire which is to be twisted around the main wire is placed in the L-shaped keeper *C*, thereupon, with the ordinary tool, the end of the wire may be twisted around the main wire. The keeper *C* will prevent the wire engaged therein from swinging outward. Our readers will recognize as commendable features of this device the extreme simplicity of its construction, the provision of the useful retainer for the wire which is to be twisted about the main wire, and the peculiar arrangement of the jaws, which, by reason of their parallel movement, present a gripping surface throughout their entire length. Mr. James C. Logue, of Haze Hill, Canada, is the inventor of this improved wire grip.

A FOUNTAIN PAINTING APPARATUS.

The time consumed by a painter in dipping his brush into a paint bucket and removing any excess of paint taken up thereby is greater than might at first appear, and any device which would do away with this irksome detail would surprisingly increase the amount of work that a painter could accomplish in a given time. Such a device has been invented by Mr. John Grahn, of Stoughton, Wis., and an illustration of the apparatus is shown herewith. The apparatus comprises a reservoir for the paint, which is led to the brush through a flexible tube by air pressure. The air



A FOUNTAIN PAINTING APPARATUS.

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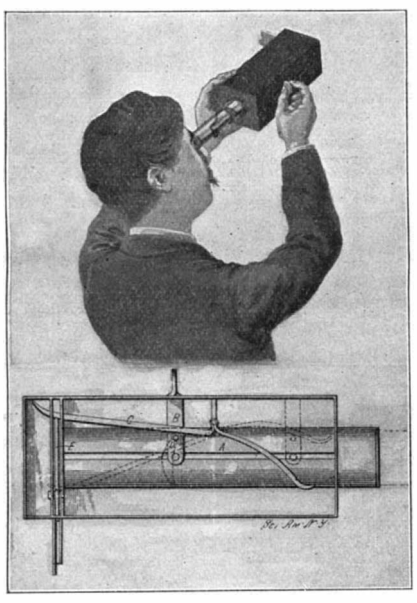
pressure in the reservoir is attained by means of a hand pump at the side, as shown in section in our engraving. The pump connects with the bottom of the reservoir, and forces the air through the paint to an air space at the top. A vertical tube mounted outside of the reservoir connects at the top and at the bottom with the interior of the same. This tube is provided with two valves, and secured to a nipple between these valves is a flexible tube, which at its lower end connects with a fixed tube in the brush handle. A valve located at the base of the handle is provided with a thumb piece, which by means of a leaf spring is normally held in such position as to close the fixed tube. The lower end of the handle is formed with a threaded stem, onto which the brush proper is screwed. The stem is also provided with an internal thread adapted to receive a short tube to which is secured what is called the "distributer." The distributer consists of fan-shaped canvas web made double, and between the folds of which cords are placed. The webs are sewed together between the cords in such manner as to form channels through which the paint can freely flow to the bristles. The distributer is necessary only for use in connection with flat brushes. When brushes of the type known among painters as "dagger stripers" are used, the distributer may be dispensed with and the paint fed to the bristles through a small nipple threaded onto the stem of the handle. In use the painter can accurately control the flow of paint through the brush by depressing the thumb piece on the thumb handle. After the painting is done the lower valve of the reservoir is closed and the upper one opened to admit a flow of compressed air through the tube and brush, discharging all paint therefrom.

A NOVEL PICTURE EXHIBITOR.

We illustrate herewith a toy picture exhibitor for which a patent has recently been procured by Mr.

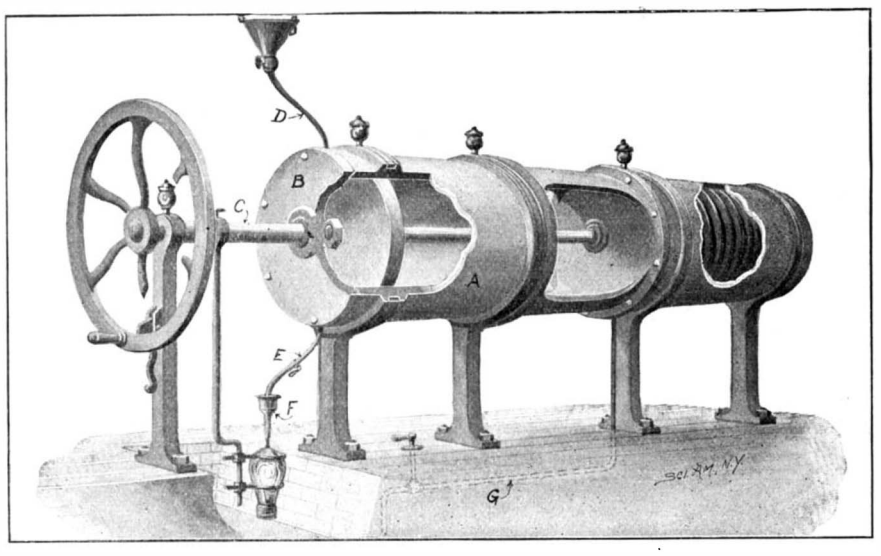


A NOVEL PICTURE EXHIBITOR.

Ulysses L. Berger, of 1332 11th Street, N. W., Washington, D. C. The principal feature of the apparatus lies in the provision of simple means for producing the effect of a moving panorama. A brief description of the construction of this apparatus will enable one to readily understand the method of producing this effect. The picture exhibitor comprises a box provided with two partitions at one end, which are separated by a narrow space in which the transparency to be exhibited may be received. A tube extends from the inner partition lengthwise of the box, and projects through the opposite end. A shorter extension tube is adapted to slide within the main tube. An arm *B*, which projects through a slot in one side of the box, serves as a means for sliding the lens in the tube *A*, being connected to this lens by a pin extending through a slot in the tube. Lying above tube *A*, and hinged to a bracket at one side of the box, is a lever *C*, which is adapted to be operated by engagement with a pin *D* on the arm *B*. The longer end of this lever projects through slots in the partitions referred to above, and rests against the picture when it is introduced into the box. Projecting from the side of the box at the point where the picture is introduced is a sliding support or guide, which affords a ready means for inserting the picture in position. Light is admitted to the transparency through coincident openings in the center of the partitions and the end wall of the box. In use the picture is first inserted and the extension tube drawn out, then the apparatus is held to the eye as shown in our illustration. On sliding the lens back and forth in the tube the figures in the transparency will be correspondingly enlarged or diminished in size, giving the effect of an advancing or receding panorama. When the lens is moved further back beyond the pivot of lever *C*, the pin *D* will engage the shorter arm of the lever, swinging it about to the position shown in dotted lines. This causes the longer arm to move the transparency *E* across the field of vision and out onto the sliding support at the side of the box. Thus the effect of a sidewise movement is added to the effects above mentioned.

VACUUM PUMP FOR BULBS OF ELECTRIC LAMPS.

A new form of vacuum pump for exhausting the air from the bulbs of incandescent electric lamps has been provided by the recent invention of Mr. Rudolph A. Steeb, of Roselle, N. J. The pump is provided with two cylinders, one of which is fixed and the other mounted to rotate. The revoluble section is shown at *A* in our illustration. A piston rod runs through both cylinders, and is provided with two pistons, one in each cylinder; the pistons are normally held in forward position by means of a spiral spring in the fixed cylinder. The cylinder head *B* of the revoluble section is secured to a shaft *C*, which is provided at its outer end with a hand wheel, by which the operator can turn the cylinder *A*. Connecting with the cylinder *A* at its forward end is a tube *D*, provided at its upper end with a funnel. A similar pipe *E* leads from the cylinder in the opposite direction, terminating in a coupling *F*. The coupling connects with the tube extending integrally from the bulb in which the vacuum is to be produced; the bulb is supported in holders adjustably secured to a rod mounted on the shaft *C*. In operation the hand wheel is turned to bring the parts in the position illustrated, then mercury is poured into the funnel, and passing into the cylinder through the pipe *D*, it thence forces its way through pipe *E* into the electric lamp bulb. The air in the bulb slowly bubbles out during this operation, and after the bulb is completely filled, a valve on the pipe *D* is closed. Then the hand wheel is given a half turn, reversing the positions of the funnel and the bulb, that is, bringing the bulb to the top. The motive agent is now admitted to the fixed cylinder through pipe *G*, which forces back the pistons, producing a vacuum in the cylinder *A*, and drawing the mercury out of the bulb. The valve on pipe *E* is now closed, and the bulb sealed by melting and closing the tube extension thereon. A new bulb may then be placed into position, and the hand wheel is again operated to bring the bulb to its lowest position. The three-way valve on pipe *G* is then turned to permit the escape of the motive fluid. This permits the pistons to move forward under action of the spiral spring, forcing the mercury into the new bulb, after which the operation is repeated as described above. A spring catch which engages the hand wheel serves to firmly hold the parts in their two positions.



PRODUCING THE VACUUM IN ELECTRIC LAMP BULBS.

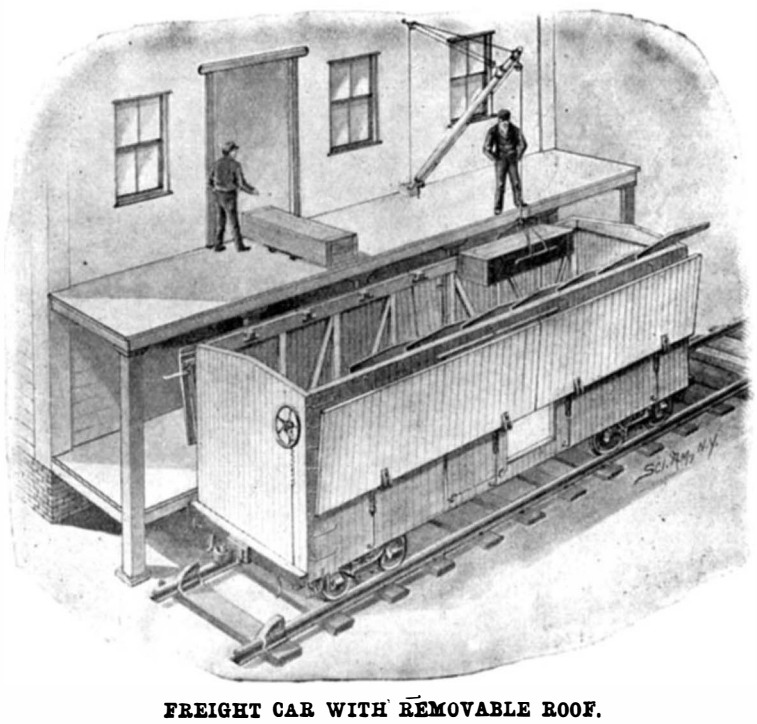
FREIGHT CAR WITH REMOVABLE ROOF.

The ordinary covered freight car—a huge closed box with a narrow door in the center of each side through which every piece of freighted merchandise must be twice handled—can hardly be said to have kept pace with modern requirements. In many cases articles which need protection from the weather have to be loaded onto flat or open cars, because they are too large to pass through the car doors or are too cumbersome to be carried therein; for, obviously, a crane or the like cannot be readily used in loading a covered car, and consequently the work must all be done manually. Another objectionable feature of the ordinary box car lies in the difficulty of completely filling the upper part of the car, and in subsequently unloading the car without dropping and injuring the merchandise. Aside from these, other difficulties will readily suggest themselves to all those acquainted with freight handling.

With this brief summary of present conditions in mind, we will more readily appreciate the advantages offered by the car with removable roof which is illustrated herewith. The car roof comprises a number of sections or doors, which meet at the center line of the car, and which at their outer edges are bolted to hinged brackets, mounted to slide on vertical guide rods at the side of the car. By this arrangement, when the doors are swung open, the brackets slide down the guide rods, drawing the doors with them, and a cam on the hinge causes the doors to assume a position close to the side of the car. Spiral springs on the guide rods prevent jarring of the hinges when the roof sections are being lowered. The roof-supporting beams are hinged to one side of the car and can be swung parallel with that side so as not to interfere with the loading or unloading of the car, but normally the beams lie transversely across the car and their free ends are hooked into sockets on the opposite side. This construction relieves the side strain against the walls of the car.

In order to prevent rain and moisture from entering the car at the joints of the roof sections, the sections are provided with weather-strips and as an extra precaution the cross-beams on which they rest are channeled so as to catch the water and conduct it out of the car. The center longitudinal joints of the roof sections are protected by runways secured to the sections at one side and fitting over weather-strips on the meeting sections. A simple locking-device holds the roof sections firmly together. The device may be unlocked by the manipulation of a lever at the end of the car. A patent for this improved type of freight car has recently been obtained by Mr. H. Addison Johnston, of Ingersoll, Canada.

Dr. George Cohen, an Allegheny inventor, has recently announced the perfection of an invention on which he has been working for some time past, and which promises to overcome the defects of the railroad block system by means of electricity. A company was formed some time ago to develop his invention, and it has been agreed to increase the capital stock to three million dollars and put the device on the market after it has been thoroughly covered with patents. Dr. Cohen is about to sail for Europe with the object of securing these patents, and on his return the details of the invention will be made public. He has announced, however, that his perfected invention will protect a train from almost any character of accident. A broken rail, for instance, will be the means of throwing the system into operation, and a train moving along in the vicinity of the danger will be stopped automatically. This invention was demonstrated some time ago in the presence of a number of railroad men, and at that time it was pronounced to be a remarkable device, but since then the doctor has spent a great deal of time in further improving it.



FREIGHT CAR WITH REMOVABLE ROOF.

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Legal Notes.

What Constitutes Invention.—Joseph B. Mockridge on March 14, 1893, was granted a patent for an invention, the purpose of which was to provide a new and improved means for securing railroads and shippers of merchandise against loss of freight, by preventing the merchandise from being sent to wrong places, and keeping a record of the merchandise loaded into each railroad car, so that it could be easily traced, until it finally arrived at its proper destination. The invention consisted in means by which the shipping was controlled in such a manner as to prevent the merchandise from being loaded into the wrong car at the shipping station; and secondly in case it should happen that a package was wrongly loaded into a car, then to detect at once the respective car into which it had been wrongly placed.

The means described in the specification may be briefly summarized as follows:

1. The cars upon which the merchandise is to be shipped are numbered, the numeral upon each car designating a destination.

2. A shipping receipt is prepared at the shipping office, containing, besides the usual descriptive matter, the number of the car into which the package is to be loaded and designating the package by a given number.

3. A check is prepared simultaneously with the shipping receipt, containing the number of the car and the numbers of the packages.

4. A removable box is placed upon the car for receiving the checks of the merchandise loaded into it.

The validity of this patent came up for decision in the case of Hock vs. the N. Y. C. & H. R. RR. The court said: "Whether the patent is to be regarded as one for an improvement in an art, or as one for a machine, we are of the opinion that it discloses nothing of patentable novelty. It purports to disclose to the public, and especially to that part of the public engaged in shipping and transporting, an improved method of preventing and rectifying mistakes in the transaction of their business. Such improvements generally suggest themselves, as their necessity becomes apparent, to the intelligent and enterprising men who usually conduct this kind of business, and it would be surprising indeed if the long and extensive experience of forwarders and carriers had not disclosed so obvious a method as that which is disclosed. What the patentee seems to have done has been to provide evidence that a certain parcel or lot of merchandise has been deposited in a predetermined place, or, if it has not been deposited there, to denote at what other place it has been deposited. There are various ways of doing this, so familiar that the court can take judicial notice of them. One is by having the person with whom the parcel is deposited preserve a record of it, to be returned for examination to the sender. Another is by having a record kept by a tallyman. Another is by having the truckman or other person making delivery return a voucher from the receiver to the shipping clerk. A common instance is that adopted by express companies who provide their expressmen with a book in which, when the parcel is delivered at a store or house, the receiver signs his name. The patentee has provided a box in which the truckman is to deposit the voucher instead of returning it to the shipping clerk, and has located it at the most convenient place, and where there is the least likelihood of his making the mistake of depositing the voucher in the wrong one. All this evidences good judgment upon the part of one who is experienced in the particular business, but it does not rise to the level of invention."

Construction of Patent Claims.—The Nash patent, No. 433,088, covers a water meter with its chamber-forming case made relatively strong, in combination with an inclosing head therefor made relatively weak, either by being made thinner throughout, or by having a weakening groove, to form a yielding part against interior pressure, the object being, as shown by the specification, to prevent injury to the other parts by freezing. This patent was made the basis of an infringement suit brought by the National Meter Company against the Neptune Meter Company (122 Fed. Rep. 75).

In delivering the opinion of the court, District Judge Archibald stated that the idea of a weakened head or part to relieve from the strain of excessive interior pressure in an inclosed chamber was not new with Nash, but that he was the first to apply it to water meters and to obviate the danger in case of freezing. To this extent he was a pioneer. He was, therefore, entitled to the fruits of his inventive skill. The expanding power of water in freezing is substantially irresistible, and operates in its own peculiar way. It is not a fluid pressure, so as to have the strain transmitted from one point to another, but it is a pressure exerted as the water turns to a solid. If freezing occurs in a meter chamber, something, by predetermined arrangement, must be prepared to give way, or the meter case will be rent asunder. Nash's fourteenth claim reads:

"The combination with a water meter having its chamber-forming case made relatively strong, of an inclosing-head therefor made relatively weak, whereby to form a yielding part against undue interior pressure."

The fifteenth claim reads:

"The case or inclosing head of a water meter case having a groove or surface recess to reduce the thickness of the inclosing-head over the measuring-chamber, substantially as described, and for the purpose stated."

The first of these claims is in very broad terms, and covers every case where the inclosing head is made relatively weak, by whatever device effected, and comes very near in this to an attempt to claim a result or idea, rather than the structural means by which it is produced or carried out, which latter is alone patentable. Neither is there any reference back to the specifications by the usual formula "substantially as described," or "for the purpose designated." Thus the ground is laid for the contention that the claim is not limited to provide against strain from freezing only, but from undue interior pressure of every character as well. The same was urged with respect to the fifteenth claim where the reference appears, but is equally unavailing as to both. Says the court: "The manifest purpose of endeavoring to broaden their scope in this way, so as to make them apply to all cases of excessive interior fluid pressure, such as water hammer or abnormal hydrostatic head, is to enlarge the art to which they are to be assigned, and so the easier to demolish them." But it seemed useless to the court to argue that either claim can be so separated from the connection in which it is found or extended to embrace a function not there specified. It is no doubt true that an element not stated in a claim cannot be brought forward from the specification and imported into it. But, said the court, that is by no means to say that the specifications which precede did not limit it, or that they are not to be resorted to as they always freely are, to explain it and give it character. It seemed to the court that the inventor, in the present instance, did not and could not claim what was thus sought to be thrust upon him. He was not seeking, in this feature of his invention, to provide against anything else but ice pressure, and while it may be desirable in all water meters to have a yielding part that will go down under stress of undue internal forces, he must abide by what he has described and claimed.

The defendants contended that a water meter is nothing more than a water motor, reference being made to a Scotch patent to show that they are interchangeable. "In structure and general mode of operation, this may be true, but for the purpose of this case it is not. A meter, however actuated, is not designed for exerting or transmitting power, but simply for measuring, registering fluid volume, and as a matter of applied art the two are essentially different. The manifest object of this opinion . . . is to draw the case within the circle of the motor or power reference relied upon, or at least to establish a close analogy to that art." To the court this seemed not very material.

Analyzing the various points relied upon by the defendant, the court came to the conclusion that the claims of the patent must be sustained and that the defendant was chargeable with infringement.

Infringement of a Trade Mark Committed in a Foreign Country.—In the action brought by the Vacuum Oil Company vs. the Eagle Oil Company (122 Fed. Rep. 105), infringement of a trade mark and unfair competition were charged. The defendant filed a plea to the bill stating "that all such acts and deeds" complained of, "if performed or done at all, . . . were wholly done or performed by it without the borders and boundaries of the United States, and wholly within the boundaries of some foreign nation." The plea further alleged that "legal proceedings had been introduced by the plaintiff to restrain the defendant from the consummation of the very acts and deeds performed in the German empire with regard to the word 'Vacuum,' which the plaintiff here again asks relief against and recovery in this suit." It was further stated in the plea that "the plaintiff had instituted legal proceedings in the kingdom of Denmark to restrain the use of the word 'Vacuum' on oil products." The complainant very properly objected to the plea on account of multifariousness, but the court overruled him, holding that all the facts stated tended to a single issue.

The point, however, upon which the case hinged, was the general question whether the courts of the United States can decide the manner in which business in a foreign country should be conducted. If the complainant's contention be true that the court acquires jurisdiction whenever it can obtain jurisdiction of the parties, it is immaterial whether the defendant, in cases of this character, be a citizen of the United States, an alien, or a mere sojourner here. The court decided that trade-mark rights acquired in the United States, whether by registration or by common law, afforded no protection against acts committed wholly in a foreign country.

To the lawyer who is at all familiar with equity practice the decision seems contrary to the long-established doctrine that equity acts *in personam*, and that it matters little where the subject-matter is situated, or the acts complained of were performed. Even before Lord Hardwicke's day, English Chancellors interfered to protect rights in property situated in other jurisdictions (witness the Penn vs. Lord Baltimore case), and sometimes even protected foreigners in their property rights, as in the case of the Emperor of Austria vs. Day and Kossuth, in which it was decided that Louis Kossuth should be restrained from printing in England banknotes which when circulated in Austria-Hungary would depreciate the value of the imperial currency. Why then should a court of equity not restrain a defendant residing within its jurisdiction from committing acts without that jurisdiction, to the detriment of the complainant?

The Limit of a Man's Right to Use His Own Name as a Trade Mark.—In the case of the Royal Baking Powder Company vs. Royal (122 Fed. Rep. 337), it appeared that the complainant company had for many years been making and selling a baking powder under the name of "Royal," by which name its product was called for by purchasers. The defendant, whose surname is Royal, commenced the manufacture and sale of a baking powder which he packed in cans similar in size and shape to complainant's, and having a label similar in color and general appearance, bearing his name in large letters. He also advertised his baking powder as the "New Royal." Having been enjoined from such advertising and from using the labels, he changed the color of the label from red to blue, on which was printed the name "Maxim Baking Powder;" but still having his name in prominent letters on the front of the cans. There was evidence that this baking powder had, in some cases, been sold as that of complainant's, and that retailers had given it to customers calling for Royal Baking Powder, without explaining that it was not the well-known product of the complainant company.

The court held that all the facts showed a purpose on the part of the defendant so to use his name as to sell his product as that of complainant, and that while he would not be enjoined from using his name, he would be restrained from placing it on the front label of his cans.

A person has the right honestly to use his own name in connection with his business, even though he may thereby interfere with or injure the business of another, but a court of equity will restrain him from intentionally so using it as to deceive the public—or enable others to do so—into buying his goods as those of another, and will require him, when entering a business in which another is engaged, and using the name, to use every means reasonably possible to distinguish his own business and goods from those of his competitor.

Laches in Infringement Suits.—In July, 1901, the Circuit Court for the Second District of New York sustained the first three claims of a patent which was made the subject of the suit of Timolat vs. Manning, and found them to be infringed by the device then before the court. Subsequently, in November, 1901, suit was brought against another infringer upon a different device and a preliminary injunction was granted by the same Judge who heard the Manning case. Appeal was taken in that case. The case which recently came up before the Circuit Court of Appeals was the case of Timolat vs. Franklin Boiler Works Company (122 Fed. Rep. 69). The appellant in this suit contended that some laches of the complainant should require a denial of injunctive relief. The defendant did not put his tool on the market until the spring or summer of 1899. Then a month or so thereafter complainant began litigation with the infringers, and have continued to litigate ever since. Circuit Judge Lacombe, who wrote the opinion, states that they were under no obligation to sue everyone at the same time.

The use of a different, but mechanically equivalent, method or material to construct some of the elements of a patented combination will not avoid infringement where the principle or mode of operation is adopted, and the elements, when constructed, perform the same functions by the same means as, or by mechanically equivalent means to, those described in the patent.

The commercial success of a complicated machine covered by a patent containing a large number of claims is not persuasive evidence, in itself, that a single element or part of the machine involves invention.

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RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRIC ILLUMINATION FOR RAILROAD CARS.—M. BUTTNER, Deutsch Wilmersdorf, Germany. The object of the improvement is to provide certain new and useful improvements in electric illumination of railroad-cars whereby the incandescent lamps burn uniformly at a predetermined candle-power irrespective of the varying speed of the train and without the use of electromagnetic regulators.

ELECTRIC SIGNAL.—H. L. LEE, Timpas, Col. In this case the invention relates particularly to electric signals for railways, designed to notify a telegraph-operator of the approach of a train, the object being to provide in connection with the signal a circuit-closer of simple construction that may be readily attached to a railway-rail at any desired point remote from the operator's station, and designed to be closed by a passing train.

Engineering Improvements.

SAND-DISCHARGING SPOUT.—A. M. HOWERY, Eastbank, W. Va. In this patent the invention relates to improvements in devices for sanding railway-rails, an object of the invention being to provide a sand-discharge spout so constructed as to spread sand evenly on the whole width of the rails either on curves or straight lines.

SAFETY-CATCH FOR ELEVATORS.—J. GENISIO, Duquoin, Ill. The present invention pertains to improvements in safety-catches for elevators, particularly elevator-cages used in mining shafts; and the object is to provide a safety-catch of simple construction that will quickly and automatically operate to prevent the falling of the cage should the cable break.

EQUALIZING-DRAFT HOISTING-GEAR.—J. G. DELANEY, New York, N. Y. Mr. Delaney's invention relates to a hoisting-gear, and his object is more particularly to produce a neat, simple, and efficient means for rendering the load substantially equal when the device is actuated in connection with a hoisting-bucket whether the bucket is loaded or empty.

CRANE.—A. P. VAN TUYL, Brooklyn, N. Y. The object in view is to produce a self-supporting crane provided with a windlass or rope-pulley attachment for hoisting or lowering articles of moderate weights perpendicularly or at an incline—as, for example, out of or into a well-hole, cellar, or stairway.

Hardware.

NUT-LOCK.—T. MCCABE, JR., Homestead, Pa. One of the principal objects of this invention is to provide a device which shall be simple in construction, positive in operation, durable, and at the same time capable of securely retaining a nut against movement, thus preventing the nut from "working off" or leaving the belt.

ADJUSTABLE WRENCH.—E. F. HIRST, Richmond, Ind. The object of this improvement is to provide details of construction for a wrench which afford a considerable range of adjustment for the movable jaw of the wrench, adapt the jaw for quick, convenient, and reliable adjustment toward or from the fixed jaw, and provide means for reliably securing the movable jaw at a desired point.

Household Utilities.

FOLDING BED.—A. W. PYLE, Hopkinsville, Ky. Mr. Pyle's invention relates to improvements in beds of that class wherein a non-collapsible bed-frame is pivotally supported in a cabinet; and the primary object in view is the provision of a portable structure which may be easily taken apart to facilitate storage and transportation and which may be assembled together for the several parts to occupy a solid firm relation to each other.

Machines and Mechanical Devices.

BRUSH DEVICE FOR CLEANING BOLTING-CLOTH.—C. W. MANN, Greenville, S. C. The purpose of the improvement is to provide a brush which is made to travel with a circular motion in engagement with the bolting-cloth, movement being imparted to the brush through the gyratory movement of the bolting machine. Means are provided whereby the brush will be made to take a course parallel with and at each side of a line drawn horizontally through a portion of the center and a course parallel with the ends of the frame, and means to prevent the brush from moving backward.

HAT-FORMING MACHINE.—G. W. CHAMBERLAIN, Atlanta, Ga. This invention pertains to improvements in machines for forming shoddy or other felt hats, the object being to form them directly from a roll of material cut to the proper width instead of cutting the material into squares, as is the usual practice, thus simplifying the operation, reducing the waste, and saving labor.

WORK-HOLDER FOR ENAMELING.—S. H. FRIST, Chattanooga, Tenn. The improvement is in machines for holding work to which enamel is to be applied, such as washbowls, sinks, bath-tubs, etc., an object being to provide a device for this purpose by means of which the work while applying the enamel may be rotated axially and vertically or in two planes substantially at right angles to each other, so that the enamel may be applied evenly on all parts and much more easily and rapidly than is possible by ordinary methods.

PERMUTATION-PADLOCK.—T. A. DINSMORE, Cameron, W. Va. Mr. Dinsmore's invention refers to improvements in locks, being particularly applicable to padlocks, its object being to provide a lock which can be opened without the use of a key, thus doing away with the annoyance of having to supply several persons with a key and the consequent liability of loss of the keys.

WOOD-CARVING MACHINE.—A. W. H. RAETTIG, New London, Wis. This invention relates to improvements in wood-carving machines designed to be manipulated and guided by hand in a way to rapidly and accurately impart a desired shape to irregular pieces of wood of all kinds, such as crooked stair-rails, crooked moldings, straight work, and, in fact, an unlimited variety of carving and woodwork. The casing of this device is made in a form and of such advantageous dimensions as to be always under the direct control of the operator. The machine can be used for offhand or carving work or worked to a drawing on wood or other material.

EXHIBITING APPARATUS.—E. BARTHÉLEMY, 34 Rue Caitbout, Paris, France. This is particularly an improvement in a mechanism for producing the successive movement of several screens in a perfectly safe manner, thus preventing the order of their succession and the full accomplishment of their movements until they come, respectively, into their positions of rest from being interfered with save in case of stoppage of the main motor.

BREECH MECHANISM.—J. B. MOORE, Washington, D. C. The claim for an object, among others, in this case, is the provision of a mechanism in which the threads between the block and the breech of a gun will be uninterrupted and cylindrical in general form and multiple, together with means for operating the moving parts of the mechanism in adjusting the breech-block into and out of position for closing the breech of the gun.

LUBRICATING-CUP.—J. M. STAPP, Alamogordo, New Mex. The primary object in view in this improvement is the provision of a simple and cheap contrivance for use on revolving or oscillating parts of machinery for the purpose of automatically feeding oil thereto when the part is in motion, while the feed is effectively cut off on the stoppage of the part, thus overcoming the waste of the lubricant.

MACHINE FOR COVERING LITHOGRAPHIC-PRINTING ROLLERS.—C. WAGNER, New York, N. Y. In this patent the improvement relates to the manufacture of printing-rollers for lithographic-printing machines; and the object is to provide a new and improved machine for drawing the leather, skin, or cover over the filling in a very simple, quick, and effective manner without requiring skilled labor.

CRUSHER.—T. E. HURLEY, Butte, Mont. This invention is of that class which relates to improvements in machines for crushing rock and the like; and the purpose intended is the provision of a crusher with its pitman-bearings of novel construction so arranged that friction will be reduced to a minimum.

MEAT-CUTTER.—A. W. JOHNSON, New Brunswick, N. J. This invention may be classified as relating to cutters which employ a trough-shaped bed and a suitable type of cutter mechanism arranged to operate in a way to cut thin slices from dried beef or other meat placed on a bed. The improvement overcomes the irregular feed of meat, because it is gripped or held against displacement on the movement of the cutter, the improvement allowing the free or uninterrupted movement of the meat toward the cutter.

Of Interest to Farmers.

WIRE-STRETCHER.—H. S. WORKMAN, Basin, Wyoming. The wire-stretcher improvement has for an object, among others, to provide a construction which can be readily utilized for taking out the slack of wires stretched along posts, can be used in stretching wires in erecting a fence, and can be used in taking out the slack at any point between posts.

FERTILIZER-DISTRIBUTER AND SEED-DROPPER.—S. S. CUDD, Kelton, S. C. The invention in the present case is an improvement in fertilizer-distributers and seed-droppers and the inventor has for his object in view the provision of a distributing and dropping machine which is especially adapted for planting corn, peas, beans, and the like.

GRAIN-LOADER.—D. BARNES, Axtell, Kan. This device is equipped with means to cut off the discharge of grain from the vehicle should the team start to pull the vehicle away from an elevator during the loading process, thus saving the loss of grain. Means are also provided to regulate the quantity of grain flowing to the elevator, and provision is made for ready access to an end-gate of the vehicle for lifting the gate subsequent to the application of a part of the loading apparatus.

FOLDING-CRATE.—E. G. SOLOMON, Omaha, Neb. This crate or box may be folded into a very compact form for convenience in shipping when empty, while the sides and ends of the crate, which are hinged or joined to the base thereof in such manner that they may be folded inward upon the base, are provided with means for supporting the removable top of the crate when the box is in its erected or extended position. When used for shipping poultry the crate is provided with stationary water and food receptacles, so arranged that they shall in no way interfere with the folding of the box.

DEVICE FOR PREVENTING SIDE DRAFT IN HARVESTERS.—G. A. SMITH, Cottonwood, J. E. PHILLIPS, Minneapolis, and J. P. SMITH, Cottonwood, Minn. The object of the inventors is to relieve the "side draft"—that is, the tendency of the machine to draw sidewise when pulled by horses, and so increase the work of dragging it forward. In machines of this kind some part of the frame projects laterally forward, and it is this part which carries the operative mechanism. Pulling is done at a disadvantage on this account. Their idea is to quicken the speed of the part of the frame in question, by drawing the grain-wheel by means of a train of gearing, while leaving the wheel free to overrun its connections.

FLY-TRAP.—F. J. LAMPTON, Weir City, Kan. In this patent the invention relates to improvements in devices for removing flies or similar winged insects from cows or other animals and trapping them, an object being to provide a contrivance for this purpose that shall be simple and durable in construction and comparatively inexpensive.

Pertaining to Vehicles.

CARRYING ATTACHMENT FOR BICYCLES.—L. MURDOCH, Washington, D. C. Mr. Murdoch's invention is an improved carrying attachment for bicycles for supporting an umbrella, luggage, and baby-seat, or any of said devices from the frame of the bicycle; and the improvement consists in certain novel constructions and combination of parts that enable the devices to be conveniently applied to and removed from the bicycle whenever desired.

Railways and Their Accessories.

TICKET-CASE.—R. A. EDGAR and W. W. TOBEY, Iola, Kan. These inventors have made an improvement in that class of ticket-cases in which the tickets or cards are held flatwise in a series or column and are pressed to the front by a spring-follower in rear of the column, and one ticket from the front of the column is discharged at a time by a spring-plunger moving in the plane of the front ticket and pushing it out endwise from the column into reach of the ticket-seller.

RAILROAD-TRACK CONNECTION.—W. F. MILLER, Brooklyn, N. Y. Mr. Miller's invention relates to the construction of railway-tracks; and its aim is to provide a new and improved rail-joint arranged to allow of joining the rail ends without the use of bolts, separate fish-plates, and the like, and to prevent sagging of the track-rails and spreading thereof.

ROADWAY AND VEHICLE FOR TRAVELING THEREON.—J. B. HANSLER, Newburgh, N. Y. This invention relates to bicycle-tracks, such as shown and described in a former patent granted to Mr. Hansler. The object is to provide a roadway for vehicles especially designed for use by automobiles and other similar power-propelled vehicles, and arranged to properly steer the vehicle without the aid of an operator in charge of the vehicle and to allow of safely running it at a high rate of speed.

Miscellaneous.

MAIL-DELIVERY BAG.—JANE F. STROH, Pittston, Pa. The aim of this inventor is to produce a simple, compact, and strong construction wherein mail-matter of different classes and articles useful to the operator may be safely carried and arranged in such a way that access may be obtained without loss of time to any desired class of mail or other articles contained in the bag. Designed for use by letter-carriers, it may be used by other persons for other purposes.

BRIDLE-BIT.—W. T. TEMPLE, Trenton, N. J. The object of this new and improved device is to provide a riding or driving bit which may be used on such animals as have tender mouths or the reverse and afford means for the control of the animal in case it becomes fractious and is hard in the mouth, but that will ordinarily serve to guide without hurting the mouth.

COAT-LINING.—M. WEBER, Brooklyn, N. Y. In the present invention the object is to provide a new and improved coat-lining having integral shoulder pads to insure proper and smooth fitting of the outer garment material without danger of creating undue ridges, creases, or humps, as is so frequently the case when using the ordinary separate shoulder-pads.

GAME APPARATUS.—J. N. ARRIAGA, Mexico, Mexico. This game contemplates the use of a chart having a series of starting divisions and a plurality of succeeding divisions arranged in order, the starting divisions bearing symbols, which appear in contrasting colors and each subdivision having similar symbols. With the chart is associated a number of dice having symbols in contrasting colors to those in the initial divisions, a number of ordinary dice, and a number of chessmen, which are placed in the initial divisions and moved into or through the subdivisions of the chart.

GAME APPARATUS.—C. KOCH and J. FISCHER, New York, N. Y. This structure embodies a table having at one end a yieldable buffer fashioned to produce a plurality of carom-surfaces, and along both sides of the table are pockets which afford track-surfaces for a rolling object. The pockets are in two series, reversely inclined to each other and converging toward the buffer, and at the mouth of each pocket is a deflector. At one end is a rail having pockets. In front of this rail is an object-retainer which fixes the point for placing the rolling object, the latter to be propelled by a cue.

ADJUSTABLE REGULATOR FOR PICTURE-FRAMES.—F. C. BROWN and W. E. CHENERY, Framingham, Mass. The improvement of these inventors relates to an adjustable regulator for picture-frames and the like—that is to say, to mechanism for adjusting and maintaining the level of frames used for the display of pictures and for analogous purposes. The device is simple, cheap, and easily handled.

CHIMNEY-COWL.—F. W. STEIN, Jersey City, N. J. The object in view in this case is to provide a cowl which will insure an effective draft through the flue. This end is attained by providing a cowl with means forming an air-duct leading upward from the back of the cowl, over the top thereof, thus causing the gases or smoke to be drawn upward through the flue and out of the cowl with the beforementioned current of air.

GAME-BOARD.—H. FRANK, New York, N. Y. This game-board is particularly adapted for the mechanical playing of the game of base-ball, and the object is the provision of a board so arranged that a rolling ball employed will indicate the various plays, that may be recorded in the usual manner, thus making the game interesting, and in the playing of it considerable skill may be acquired.

COMBINED BROOM-HEAD HOLDER AND SHAPER.—T. MCE. GILL, Mexico, Mo. In the present case the invention relates to an improvement in broom holders and supports designed to be attached to a wall or other locality, and has for its aim the provision of a device which will support and clamp a broom-head and at the same time restore and preserve the normal shape of the head.

STRAP GRIP OR BUCKLE.—J. H. WALLACE, The Brake, Fife, Scotland. A former patent granted to Mr. Wallace related to an improved strap grip or buckle for use in snaffling or hobbling horses and for connecting the ends of straps for any other purpose. His present invention is embodied in an improved form of grip or buckle adapted to secure a strap by its automatic action, a tongue such as is usually employed in buckles being dispensed with.

FASTENING FOR SHOES, ETC.—F. PASCHEN and J. DUCKRO, Tampa, Fla. The inventors have made an improvement in that class of shoe-fasteners in which buttons, hooks, or lacings usually employed are dispensed with. More particularly the invention is an improvement in that class of fastening in which a slidable member engages opposite guides secured to opposite edges of the slot in the shoe-upper.

PENCIL-HOLDING CASE.—A. G. BLINCOE, Bardstown, Ky. By means of this invention a pencil can be carried in the pocket with perfect safety without any danger of the point becoming broken, and there is provision whereby the case can be adjusted to suit the length of the pencil, and the lower end of the case is covered by a removable cap, and if the pencil slips through the springs at top it may be pushed up by pushing the lower section up so it can be taken hold of by the upper end.

HAIR-BRUSH.—D. M. NEWBRO and E. E. GALLOGLY, Detroit, Mich. In carrying out their improvement these inventors have particularly in view as an object the provision of a brush which will possess certain sanitary features and advantages. The article provided performs the functions of the ordinary bristle brush, the brush being manufactured only of such substances as are non-absorbent and capable of rapid and effective sterilization.

ROPE-CLAMP.—A. A. NEWELL, Mellette, S. D. The object claimed by this inventor is to provide details of construction for a clamp which adapt the clamp for the support of material which may be connected by the clamp to a rope whereon the clamp is mounted and also to enable the convenient change in position of the clamp on the rope and a hooked connection of the clamp with a ring on a chain or an equivalent fixture on a rope whereon the clamp is mounted.

HOOF-PAD.—J. CAMPBELL, New York, N. Y. In this patent the invention relates to pads for use with horseshoes to act as cushions, and more particularly to pads of the type employed with shoes terminating at the quarter. The object is to provide a pad of the type indicated which will tend to expand the hoof and will yield in a downward direction to the pressure of the frog as the latter grows. A further object is to combine with solid heel portions a pneumatic front portion and provide an arrangement for renewing the air in the hollow of the hoof.

DEVICE FOR FASTENING METAL, ETC., TO STONE.— T. P. HICKS, New York, N. Y. Mr. Hicks in his invention provides a novel socket and means whereby it may be secured in a stone or in a wall for receiving a bracket or other suitable device for attaching to the stone or wall any desired article of wood or metal.

FAUCET.—W. T. NICHOLS, Hempstead, N. Y. The object in view in this invention is to provide a new and improved faucet which is simple and durable in construction, very effective

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in operation, and arranged to prevent leakage, as the valve proper is held to its seat by the pressure-supply and opens against the latter when manually actuated.

Designs.

DESIGN FOR A WHISK-BROOM HOLDER.—M. A. SKALL, New York, N. Y. In the present case the ornamental design relates to a whisk-broom holder. The upper part of the holder comprises three hinged mirrors. The lower part consists of an ornamental tapering broom holder.

DESIGN FOR COFFEE-POT OR SIMILAR ARTICLE.—E. PIEPENBRING, Washington, D. C. This design is for a coffee-pot or the like of symmetrical form elongated vertically and narrowing toward its upper and lower ends, the spout and the handle being correspondingly elongated and the spout uniting with the body near the lower end thereof and extending upward alongside of and conforming to the curvature of the body to a point near the upper end of the spout where the latter is curved outwardly.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 4442.—For makers of wind mills.

For hoisting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 4443.—For firms that manufacture and supply dealers or jobbers with electric insoles.

Morgan Emery wheels. Box 517, Stroudsburg, Pa.

Inquiry No. 4444.—For the manufacturers of Prof. Wingren's electric insoles.

"U. S." Metal Polish. Indianapolis. Samples free.

Blowers and exhausters. Exeter Machine Works, Exeter, N. H.

Inquiry No. 4445.—For makers of steam motor cars.

Mechanics' Tools and materials. Net price catalogue. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 4446.—For makers of petroleum launches, having a self-starting engine.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 4447.—For all sorts of electric dynamos for lighting, nickel, and electroplating purposes.

FOR SALE.—Patent (No. 487,561) on Book or Copy Holder. B. Gardenier, Chippewa Falls, Wis.

Inquiry No. 4448.—For makers of foot power launches.

Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

Inquiry No. 4449.—For manufacturers of Almond's flexible metallic tubing.

Gear Cutting of every description accurately done. The Garvin Machine Co., 149 Varick. cor. Spring Sts., N.Y.

Inquiry No. 4450.—For a machine for filling a 4-ounce bottle with tooth powder.

Bargain, 300,000 feet seamless steel tubing, 5-16 to 2 inches diameter. The Cleveland Distributing Co., Cleveland, O.

Inquiry No. 4451.—For a machine for labeling bottles.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 4452.—For the name and address of the builders of the "Essex" hot air engines.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 4453.—For makers of electric motor wheel chairs.

Contract manufacturers of hardware specialties, machinery, stampings, dies, tools, etc. Excellent marketing connections. Edmonds-Metzel Mfg. Co., Chicago.

Inquiry No. 4454.—For makers of lumber planers and matchers.

WANTED.—Canadian agent to sell patent on the only practical lace curtain rack ever invented. A paying proposition. Address Standard Mfg. Co., Xenia, Ohio.

Inquiry No. 4455.—For makers of adding machines.

Matthews Torpedo Launches. Matthews & Co., Bascom, Ohio, U. S. A. Builders of high grade power boats.

Inquiry No. 4456.—For makers of a light die press which will bolt to the bench, and will punch out 4-inch round checks of thick press board, cardboard, light brass and heavy tin.

WANTED.—Some one who is able to give United States patent No. 705,886 a practical test and develop same on equitable basis. J. W. Wehmeyer, 2241 Warren Street, St. Louis, Mo.

Inquiry No. 4457.—For machinery for rolling out gum or manufacturing chewing gum.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

WANTED.—Philadelphia selling agency for leading manufacturer. Building materials preferred.
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WANTED.—Patent Office draughtsmen; only thoroughly experienced men need apply. Must show specimens of patent drawings. Munn & Co., SCIENTIFIC AMERICAN office, 361 Broadway, New York.

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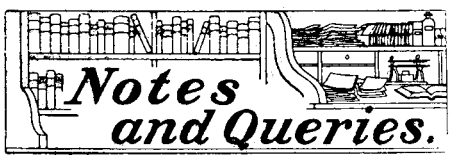

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(9110) T. W. A. asks: 1. A railroad train going at a rate of over 60 miles per hour rounds a sharp curve. Will the train if it should leave the track be likely to fall outward, or does the raising of the outside rail overcome this tendency and make it likely to fall inward? Grant the following: If the track were level, the train would fall outward, now if the outside rail is raised, will it fall inward? A. A railway train rounding a sharp curve at a high speed cannot under any supposable conditions fall over in the inner side of the track. The elevation of the outer rail is made such as to overcome the tendency to overturn to the outward side of the track, and the train goes round the curve as if on a level, when it moves at the speed for which the elevation of the outer rail was calculated. If the velocity of the train very much exceeds the velocity for which the outer rail has been elevated, the train would leave the track on the outer side of the curve. The tracks for bicycle racing are made very steep at the turns in order to enable riders to go round the turns at full speed, and when rounding a turn the rider feels in equilibrium while leaning far in toward the center. To him he is as if riding on a level. The centrifugal force is neutralized by the elevation of the track or rail. 2. What nationality was the captain of the "Columbia" in the last cup races? A. Capt. Barr commanded the "Columbia" in the cup races. He was born in England.

(9111) A. H. S. asks: How much more sunshine is there at the equator than at the north pole during the year? Where are the longest days—at the equator or the North Pole? We have a great argument over this question. A school teacher and others contend that the sun shone longer at the North Pole than at the equator, and I thought it absurd, so we decided to leave it to your good judgment. A. At the equator the sun rises and sets at six the entire year. All days are twelve hours long, and all nights of the same length. Disregarding the effects of refraction and cloudy weather, the sun is above the horizon at any place on the equator and shines just half of the year. This half-year of sunshine is divided into equal parts of twelve hours each. At either pole the sun is above the horizon for six months and below it for six months of the year. There is but one day of six months' duration and one night of the same length in a year. You will see from this that there is the same duration of sunshine at the poles as at the equator. The same is true for any place on the earth. Add the length of sunshine for all the days in a year in our latitude, and the sun will be just a half year. The longest day is at the pole, and it is six months long.

(9112) E. R. says: Would you please oblige me by answering a few questions concerning the motor given in SUPPLEMENT No. 1210, under the heading "How to Make a Sewing Machine Motor Without Castings," by Cecil Poole, for about $5, with the labor? The wire alone cost me $6.66—3 pounds of No. 21 wire on each field coil, 27 layers deep, and 66 turns wide. Why must the field have so many ampere turns? Would this motor work as a generator with an adjustable rocker arm? Would it light nearly two 110-volt lamps? A. If you build the motor according to the last paragraph of the description on page 19394 of SUPPLEMENT No. 1210, for ¼ horse power, and connect it in shunt, you will probably be able to light two 16-candle 110-volt lamps with it as a dynamo. As to the figure of cost given by Mr. Poole ($5), while this was true in 1899, it can hardly be expected to remain true indefinitely. Prices of material are very much higher now than they were then.

(9113) G. T. asks: How to remove gases of combustion and decomposition from a small room. Passing the air through a liquid would not be objectionable. A. To purify air, remove the solid particles by passing the air through cotton; the moisture and ammonia and germs, by passing through sulphuric acid; the sulphur, by passing through a solution of lead acetate. Pass now through calcium chloride or soda lime to remove last traces of moisture, etc. Only pure oxygen, nitrogen, and argon remain.

(9114) F. C. F. asks: 1. What is the best method to produce lantern slides in which the high lights will be clear glass and the shadows dense enough for the lime light? I print by contact, and have used for developing hydroquinone, metol-hydroquinone and pyro, and an acid fixing bath, yet there always is a slight veil over the high lights. A. The only mode in which lantern slides can be produced with no development in the sky and high lights is to have a negative which is opaque in the high lights. 2. Can you give a simple method by which an amateur could color lantern slide transparencies? A. To color slides requires artistic sense and knowledge of the mixing and applying of color. We think that is all that is required. Much assistance can be had from the chapter on coloring slides in Hopkins' "Experimental Science." This book also gives instructions for making slides as well as cameras, and an exhaustless amount of scientific experimenting. 3. Why is it that water when flowing through a funnel or into a small outlet always whirls, producing a depression or an opening over the outlet? Why is the whirling always counter-clockwise? A. There is probably something in the shape of the outlet of a funnel or wash basin which determines the course of the liquid as it runs out. A loss of equilibrium is soon seen, and the water whirls. Centrifugal force is produced, causing the opening into the pipe below. We would try to explain why the whirling is always counter-clockwise if it were so. We have just tried a wash basin, and found the motion always clockwise when left to itself. By a motion of the hand it could be made in either direction. Probably some inequality in the orifice determines the matter.

(9115) A. M. says: 1. In answer to query 8996 in the issue for May 9, you clearly explain the working of a radiometer. Please tell me why it will not work as well in open air as in a vacuum. A. The radiometer only works at a particular degree of vacuum. Too little gas in the tube, and there is not enough energy to the radiation to rotate the disks; too much gas, and there is too much resistance to the motion for the feeble energy of radiation to start the disk. 2. Why will a single-phase alternating electric current not start a direct-current motor, if the relative polarity of field and armature be the same, whatever be the current phase? A. An alternating current will only run a direct-current motor when the alternations exactly coincide with the change of the brushes from one segment of the commutator to the next. This is the case when the speed of the armature is in step with the alternations. For this reason the motor must first be brought up to speed by some outside motor and the current then switched on. 3. Will the precession of the equinoxes put the seasons, after a time, in different months, for example, summer in October or November? A. The calendar is adjusted so that the year will always correspond with the season. Winter will be as now and summer in the same months as now forever.

(9116) O. D. says: Kindly inform me whether or not there is a substance which will resist the lines of force of an electric magnet, I mean to resist them, not screen them as iron will. A. There is no known material which will present resistance to the passage of magnetic force. It must be apparent that a force which has passed through the earth and the air will not be retarded any more by passing through materials the same as it has already passed through. The screening action of iron upon lines of magnetic lines of force is perhaps not understood. It screens a space from magnetic force because iron furnishes an easier path for the magnetic lines than any other material. Hence the magnetic lines leave that space and pass through the iron. Iron presents less resistance to the passage of magnetism than any other known material.

(9117) C. K. B. N. writes: Can you tell me where I can get a complete report of the findings or extracts from the report of the delegation which came to this country several years ago from Russia, and which made a tour of investigation of our scientific schools? A. If you write to the United States Commissioner of Education, Washington, D. C.; we think that he will be able to tell where you could obtain the report you desire.

(9118) J. B. M. asks: Can a single wire carry a current to produce electric light, run a sewing machine, operate telegraph instruments, and a telephone service, all to be in use at the same time, and with perfect safety to the operator? A. We suppose the same current can be used for all the purposes you name and for all others at the same time. It is done all the time. It is only necessary to have the various motors and instruments wound for the voltage of the current. We cannot guarantee *perfect safety*, however. Electric service is safe if ordinary caution is exercised in its use at all points.

(9119) A. F. S. says: I am building a Ruhmkorff induction coil to give a 6-inch spark and write for some advice, for which I would be very grateful. I propose to make the coil in eight sections insulated from each other with hard rubber disks and paraffine. The size of wire to be used in the secondary is No. 36 B. & S. Now what I desire to know is this: Can a coil of this size be made to operate successfully by using single cotton-covered wire instead of silk, having the coils boiled in paraffine? I think that cotton would do well enough, especially if it is soaked in paraffine. And other precautions taken to thoroughly insulate the windings. I made a small coil, using cotton-covered wire in the secondary when silk was advised, and the coil worked well, so I am thinking that cotton-covered wire would work successfully with a large coil if built in a number of sections. If you know of coils being built by using cotton-covered wire, would like to know of it, as it would give me some confidence in cotton. A. We do not advise the use of cotton-covered wire in a coil built to give a spark as long as 6 inches. The reason for using silk is not that silk is a better insulator. No porous insulation is any better, of course, than the same thickness of air. Silk is used because it does not occupy as much room as cotton and more turns can be put into the same space. It is most important to bring the turns as near the primary as possible where the induction is strongest. With silk insulation this is best secured. We do not doubt that a coil can be constructed from cotton-covered wire to give a long spark. More wire per inch will be required if cotton-covered wire is used.

(9120) A. B. S. writes: As a long reader and subscriber of your publications, I desire to ask if there is any secret in the preparation of fluoroscopic screens for X-radiance, or if the high price is due to the high-priced material—platino-barium-cyanide (or tungstate of calcium). Where can they be procured? A. There is no secret in making a fluorescent screen for X-ray work. Skill only is required to distribute the crystals with perfect evenness and to attach them to the cardboard by the adhesive employed. The crystals must also be of uniform size, sifted through a sieve of rather a fine mesh. We should buy rather than try to make one. The cost is in the material used. It is advised that barium-platino-cyanide only will be satisfactory, since tungstate of calcium is fluorescent for quite a time after it is excited. It is cheaper but poorer, and is little used now.

(9121) J. B. S. says: I want to excavate earth and move the same to make a fill of about 60,000 cubic yards. If you know of any machinery that will do this, I would be pleased to hear from you. I do not want to go to the expense of a steam locomotive excavator. A. The only suggestions that we have to offer you for excavating earth are a steam shovel or to use hydraulic means in case there is a sufficient supply of water in the vicinity.

(9122) F. H. says: In Notes and Queries of June 13, 1903, No. 9056, C. B. C. asks: "What would happen if a direct-current motor were connected with an alternating current dynamo?" You answer: "If the alternating current were sent through a direct-current motor at rest, it would be heated and burn out." The theory here may be all right, but in practice it does not work. I had a No. 2 Porter motor, and a 110-volt direct-current dynamo, which I ran with a 110-volt alternating current. The dynamo would run as a motor with the full current, but the Porter motor required to have some assistance put in the circuit, or else it would burn out the one ampere fuse which I used. Both motors would start from a standstill, but the armature of the dynamo had to be placed in a certain position, or else it would stick and emit a buzzing sound. What was the cause of the noise? It seems to me that as you can reverse a direct current, and have the motor go, just the same, an alternating current which simply reverses back and forth, continually, would run the motor just as well as the direct current. A. The dynamo which you say will stand an alternating current of 110 volts is probably series-wound, and so has the benefit of the entire resistance of its coils to act by their self-induction in cutting down the current. If you would turn the current upon a large shunt-wound motor, we think you would see the fire fly or the fuses blow. Your dynamo did not start from rest in a proper sense. You say you had to set the armature to make it start. The usual way to run a direct-current motor on an alternating current is to have the armature turning rapidly when the current is thrown on. The "sticking" of which you speak is the refusal to turn. There is no sticking in the ordinary sense. The buzzing sound you hear is the note produced by the alternations of the current in the wire of the dynamo. It can always be heard in an arc lamp and coils generally when an alternating current is passing through them. Your reasoning about reversing a direct current and still having a motor go, and applying this to an alternating current, is not correct. When a direct current is reversed in a motor, both the field and armature has the current reversed in them, and the resulting polarity is the same. Two reversals leave the current the same as before. This is of course not the case with an alternating current.

(9123) T. C. G. says: Can you give me reliable rules for finding the sets of elliptical and spiral car springs? Also the length a bar should be to make a spiral car spring of a given free height? Do you know where I could buy a book dealing with car springs? A. The question of calculating elliptical and spiral car springs to give definite results is an exceedingly complicated one, and one that requires considerable experience as well as theoretical knowledge. You will find quite a complete discussion of the theoretical side of this subject

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in the last edition of Lanza's "Applied Mechanics," with which we can supply you for $7.50 by mail.

(9124) A. E. K. says: The owners of one of the mills in this vicinity are having a great deal of trouble with foaming of the water in the boilers, and have made a trial of very nearly everything that has been suggested to remedy this. A sample of the water was sent to the University of Minnesota for analysis, and I inclose copy of a letter received in reply. If you can suggest anything that would be of service the favor will be greatly appreciated. A. We doubt if it will be possible for you to avoid trouble from foaming with water containing as much organic matter as the analysis which you inclose shows. If it is possible, we would advise another source of supply, even though the expense of procuring it is considerable. If this is impossible, the only practical suggestions which we have to offer are: 1. Blow off your boiler very frequently and very generously, so as to prevent the impurities becoming concentrated. 2. Do not force your boiler, but if necessary, increase your boiler capacity so as to be able to generate the steam that you require at a low rate of evaporation. 3. In case you have a sufficient supply of water, we would strongly advise you to introduce surface condensers, only adding enough impure water to your boilers to make good the leakages. 4. In case there is not sufficient water supply to enable you to use surface condensers in the ordinary method, we would advise your building a shallow evaporation tank to cool the condensing water, so that you may use the same condensing water over and over again in your condensers. This will require only enough water to make good the evaporation. Either of the suggestions contained in No. 3 or No. 4 will give a satisfactory solution of your problem, but we doubt if anything else will.

(9125) M. F. F. asks: 1. State what effect oil or greases in a boiler may have upon the boiler itself. A. In answer to your first inquiry, we would say that greases in a boiler are almost always injurious, as they cause foaming and are apt to decompose, forming acids which affect the plates of the boiler injuriously. A small amount of pure mineral oil like kerosene will sometimes tend to loosen a scale which is troublesome and prove beneficial, but grease should not be used for this purpose. 2. Where low-pressure engines are used, state what vacuum is maintained? A. We infer that your questions regarding low-pressure engines refer to marine practice. The vacuum maintained here varies with the design of the engines and the condensers from 24 to 25 inches of mercury to 27 or 28 inches. 3. What is meant by this amount of vacuum? A. The amount of vacuum is usually expressed in inches of mercury. If the vacuum were perfect, it would be equal to the full atmospheric pressure, which varies with the weather, but on an average is equal to 29.9 inches of mercury, or 14.7 pounds per square inch. A condensing engine can never have a perfect vacuum because it cannot cool the exhaust steam far enough. The lower the temperature to which it does bring the exhaust steam, the more perfect will be the vacuum.

(9126) T. N. K. says: Will you kindly give me horse power of a fore-and-aft compound engine 8 and 17 x 12, 200 pounds boiler pressure, 300 revolutions per minute, 25 inches vacuum? A. You do not give sufficient information in your letter to make it possible for us to exactly calculate the horse power of 8 and 17 x 12 tandem compound engine which you mention. The power varies with the point of cut-off in the two cylinders, the amount of compression and the throttling of the steam during the admission and exhaust. If the engine is well designed, however, the power does not probably vary very much from 250 horse power when running at 300 revolutions per minute with a boiler pressure of 200 pounds and 25 inches vacuum. We would require indicator cards from both cylinders to give information necessary to figure exact horse power.

(9127) G. G. L. says. Will you kindly answer the following? I refer to two-cycle gasoline engines. 1. What are considered the best relative positions of exhaust and inlet ports. Should the exhaust be full open before the inlet is uncovered, or should it open some time before? What is the cause of back firing? Is it due to slow burning of the mixture or bad position of ports? A. Theoretically, the exhaust valve should fully close and the inlet valve should open wide at the same instant—when the piston is at the end of its travel. In practice these conditions are fulfilled as nearly as possible. The exhaust valve should close just as early as is possible without compressing the burnt gases in the cylinder, and the inlet valve should open just as soon as the exhaust valve is closed. If the action of the inlet valve is slow, it may sometimes be set to open just a trifle before the exhaust is fully closed. Back firing is usually caused by the failure to explode the gases in the cylinder and their burning after they are exhausted. 2. What is the best ratio for compression space and how far can compression be carried without danger of premature explosions? A. A common proportion for the clearance or compression of a gas engine is 33 per cent of the cylinder volume or piston displacement. The best proportion varies somewhat, however, with the size, make and speed of the engine. Compression could be carried much beyond the point reached with the above proportions without fear of its causing premature explosion. 3. What is the rule for computing compression? Suppose we have a cylinder with 6 inches piston travel, and it is pushed up 3 and 4 inches respectively. What would be the pressures? A. A very approximate rule for computing roughly the compression is: "The absolute pressure is increased in the same proportion that the volume is decreased." This would be exactly true if the temperature of the gases remained constant during the compression. As the gases are heated, the pressure is somewhat higher than this rule indicates. Example: Suppose a cylinder with 6 inches piston travel and 33 per cent clearance. Total volume = 8 inches × piston area. If piston is moved up 3 inches, volume = 5 inches × piston area. Absolute pressure before compression = 15 pounds. Pressure after compression = 15 × 8-5 = 24 pounds absolute = 9 pounds above the atmosphere. In the same way, if the piston moved 4 inches the pressure would be 15 × 8-4 = 30 pounds absolute, or 15 pounds above the atmosphere. The exact formula is:

$$p_0 V_0^{1.405} = p V^{1.405}$$

where p_0 and V_0 are the pressure and volume before expansion and p and V are the pressure and volume after expansion. 4. What is the best proportion of bore to length? Is there any objection, other than the cost of manufacture, to have the stroke say 50 per cent more than the bore? A. There is no rule governing the ratio of cylinder diameter to stroke except the consideration of cost and convenience in manufacture and convenience in cooling the cylinder with water jackets. For small engines a common proportion is to have the diameter equal the stroke, but for larger engines the stroke is usually greater.

(9128) W. B. M. says: Will you kindly answer the following inquiry? Is the weight of water in a boiler "under steam pressure," additional pressure on bottom of boiler? Is the result the same when the water is above boiling heat, and when it is not? What makes a good belt dressing? A. The weight of water in a boiler under steam pressure *is* additional pressure on the bottom of the boiler, and the result is just the same when the water is above the boiling heat. Heating water does not change its weight. One-half neatsfoot and one-half castor oil makes a good belt dressing.

(9129) E. C. T. says: I want to perform before our Sunday school an experiment to illustrate the effect of sin upon a life, and then the redeeming power. I know of such an experiment having been performed, and would like to know just what solutions to use. I prefer to start with a clear solution, and then by adding another preferably clear solution to get a bright and attractive color, then by adding more of the same or another solution to gradually darken it until it becomes black, then I want to add something that will bring it back to its original clearness. If you can suggest the solutions you will confer a great favor upon me. A. There are many ways of obtaining a dark precipitate from two colorless solutions, but none of these are easily or quickly cleared to a colorless state again. They do not answer your purpose as an illustration of sin and forgiveness. But why use a dark or black color at all? Scarlet or crimson are the colors given in Scripture (Isaiah i: 18). These can be produced and cleared off very easily. Make a strong alcoholic solution of phenolphthalein, and a strong solution of sodic hydrate in water. Add the first solution to the second slowly with shaking. At first as bright and delicate a rosy color as you may wish can be obtained. As the strength increases, the color deepens to any degree of darkness, deep enough for the verse referred to. Then add hydrochloric acid, and the red will immediately disappear. This would seem to meet your wishes. We give you also a process by which you can obtain a dark brown muddy deposit and dissolve it quickly. Take the phenolphthalein and sodium hydrate solutions as above, but more dilute, and proceed as above; then add to the bright red solution a few drops of solution of iron chloride, more or less to produce a thick muddy brown mixture. A solid is precipitated from the solution. It is hydrate of iron. To clear this away, add hydrochloric acid. This leaves a yellow liquid which, in a dim light, will look almost white or clear. Some practice may be needed to obtain the desired strength of solution, but when the solutions are right, the effect is surprising to those inexperienced in chemical manipulation.

(9130) F. R. M. asks: 1. What is the green deposit that comes on the binding post of the carbon of a LeClanche cell, and also of a Bunsen cell? A. The green substance formed on the binding posts of LeClanche cells is principally chloride of copper from the copper which the brass contains. In a Bunsen cell it might be nitrate of copper. 2. How are LeClanche and Joule commonly pronounced? A. The custom in America is to pronounce LeClanche as an English word of two syllables, as if spelled Ler-clanch, *a* having the sound *ah*. The second syllable is like the word *avalanche*. The correct French pronounciation is in three syllables, the first two pronounced as above, and the third like *shay*. The accent is on the last syllable. Joule is an English name, pronounced Jool. The *ou* has the sound of *oo* in school. 3. What is the pronunciation of Prof. Curie's name, he of radium fame? A. The credit of the discovery of radium is due to Mme. Curie, and not to her husband. The name is pronounced Cu-ry. *Cu* has the sound of *ku*. 4. What causes the great heat that is developed in a water rheostat? The one I have experimented with has lead plates and dilute H_2SO_4. A. The energy of the current is dissipated in heat in a rheostat, and the heat increases as the second power of the current. Twice the current gives four times the heat. 5. Why does the resistance fall off so rapidly as it heats? Is it due entirely to the rise in temperature? A. We have no data for the change of resistance of water by heating. As an electrolyte its resistance is less when hot, and more current would flow, which would in turn produce more heat. You probably have some salt in the water, and it would make the heating greater. 6. With a bi-convex lens is it possible for both object and image to be larger than the lens? If so, how can the diagram be drawn? The customary way is to draw from each extremity of the object one line through the center of the lens and one either through the principal focus or parallel to the principal axis. But this latter line could not be drawn in this case. How then can the extremities of the image be located? A. Certainly, both object and image may be larger than the lens which forms the image, else how could a photograph be made any larger than the opening of the lens? The rule quoted for drawing images is only useful in simple cases. The higher works on optics give general rules which depend upon the index of refraction and which will resolve any case. 7. On what principle does the spark coil used in gas lighting operate? The one in my cellar has no make and break, and yet it gives a continuous spark at the burner. A. There are many forms of gas lighters, and we cannot explain the operation of yours from your brief statement about it.

(9131) C. M. asks: Kindly inform me if I can make a plate electric machine from a sheet of glass 2 feet x 2 feet x ⅛ inch, or if I shall need a heavier piece of glass. A. A Holtz or Wimshurst machine can be made from plates of glass ⅛ inch thick. There is little lateral strain in running them at any usual speed.

(9132) E. S. asks: 1. Will a current from an alternating-current dynamo drive an electric motor, such as fans, sewing machines, etc.? A. An alternating current will drive an alternating current motor either for running a fan or sewing machine or any other machine. The motor must be adapted to the current which is to run it. 2. Is the current as powerful after it has gone through the motor as it was before, or not? A. A current is not as powerful after it has done its work as before. If a motor requires but a part of the voltage of a current, the remaining part can be used after the first has been used; but if all the voltage is taken by the first motor, there is nothing left to run a second. 3. How many small motors, say 1-60 horse power, could be run on one circuit of batteries, say four cells of ordinary dry batteries? A. As many small motors can be run on four dry cells as will use up the voltage of these cells. They will give about 5½ volts if put in series.

(9133) D. N. S. says: 1. I am supplied with electricity for lighting my house, which is supposed to be a current at a pressure of 50 volts. I have incandescent lamps that were purchased for a current of 55 volts. When placed on my circuit of 50 volts they give less light than the regular 50-volt lamps. Do they use a correspondingly smaller amount of electricity? That is, when the electric light company reads my meter, will it register a smaller amount if I use the 55-volt lamps than if I use the 50-volt lamps? A. It is not economical to use a 55-volt lamp upon a 50-volt circuit. It uses proportionally less current, to be sure, but it does not produce a proportional amount of light; it produces less light than a proportional amount. This is due to the fact that the smaller current does not heat the filament to as high a temperature as it should be heated to produce its rated candle power of light. 2. After incandescent lamps have been in use a considerable time, they give less light than when new. Do they use a correspondingly smaller amount of electricity? That is, if the light from an old 16 candle power lamp is about equal to that of a new 8 candle power lamp, will the meter register faster if the old 16 candle power lamps are used than if the 8 candle power are used? A. An old 16 candle power lamp which is giving but 8 candles has passed its "smashing point," and should be broken forthwith. It will use more current than a new 8 candle power lamp. The decrease in the amount of light an incandescent lamp gives is due to these causes: 1, the filament becomes smaller by the driving of the particles of carbon over upon the glass bulb; 2, the inner surface of the bulb becomes black and partially opaque, so that all the light which is produced does not pass through the glass; 3, the filament becomes more able to emit heat, and thus does not become as hot as at first with the same current. These changes in the filament continue till it breaks. 3. The manager of our electric light company says that an incandescent lamp that has been used a considerable time gives less light but uses more current than new lamps, so that it is economy to throw away lamps after they have been in use some little time, even though the light given by them is sufficient for the purpose for which they are used. Is this true? A. The lamp takes less current than when new because its filament is smaller, as is shown in answer to last question. It does not take more current than when new, but it takes more in proportion to the light it gives than when it was new. It is good economy to throw a lamp away when it has become reduced to 80 per cent of its initial candle power. The whole subject is fully discussed in Crocker's "Electric Lighting," Vol. ii., price $3, in the chapter upon Incandescent Lamps.

(9134) G. H. H. asks: 1. Will you please explain how to calculate the drop of a primary battery—a Bunsen for instance? A. The explanation of the calculation of E. M. F. of a primary cell is hardly a topic for Notes and Queries. It is quite too abtruse, and would occupy too much space. We would refer you to the electro-chemistries; Arrhenius, price $3.50, or Jones, price $1.50, are reputable authors. The subject occupies large chapters in each of these works. It is calculated from the osmotic pressure and solution pressure of the substances. You will require a working knowledge of the calculus to read the works in question. 2. Also how to construct a Bunsen primary cell which shall have a drop of 13 per cent in E. M. F. at normal discharge. A. We confess we do not know and cannot find in any of our reference books how a cell can have "a drop of 13 per cent in E. M. F. at normal rate of discharge." So far as we know, every cell has a drop of its entire E. M. F. on connecting its poles by a wire, whether the rate of discharge be normal or not. 3. The internal resistance of a battery is made less by having the plates close together. What determines how close they may safely be put? A. The distance between the plates of a battery may be as small as will allow a circulation of the liquid. The liquid becomes weak in the action of the cell, and if it cannot diffuse and bring other and stronger liquid into contact with the plates, the cell will give out sooner than it should. 4. If you want to construct a given number of primary batteries to give a certain number of ampere hours, will the exact number of ampere hours do, or is it better to increase them by say 20 per cent? In other words, should a battery be completely exhausted in practice? A. An allowance should be made in constructing a battery, so that it will give the desired current during the whole time of service. Otherwise the latter portion of the time the service will be feeble. The principle is the same as a factor of safety in an engineering work, such as a bridge. 5. What is the resistance of r_1 r_2 r_3 in parallel? Is it

$$\frac{1}{\frac{1}{r_1}\ \frac{1}{r_2}\ \frac{1}{r_3}}$$

A. Your expression for the combined resistance of three resistances in parallel is correct. See Thompson's "Elementary Lessons," price $1.50. 6. What is the normal rate of discharge of a primary battery, and how do you find it? How do you construct a battery to have a given normal rate of discharge with a given external resistance? A. We never saw the phrase "normal rate of discharge of a battery," so far as we can recollect. If you had referred to the book and page where it occurs, we might determine its meaning.

(9135) L. M. H. asks: Will you kindly tell me if there is any way of telling accurately the amount of electricity in a storage battery? I find in my launch that the voltmeter does not fall much until the energy is very much exhausted. A. A storage battery should be recharged when the voltage has run down to 1.8 volts per cell. This you can calculate from the reading of the voltmeter. You can also keep account of the ampere hours which have been taken from the battery and know how many remain. The ampere-meter will enable you to do this. Apart from the instruments, there is no certain mode of telling the condition of the battery.

(9136) H. M. W. says: Will you kindly tell us if a reversing gear as used on a gasoline launch should be capable of reversing the direction of the propeller instantly, when the engine is running at full speed? We are inclined to think the reverse should be applied with a certain amount of time to allow the clutch to engage. The effect of a gear we have, when suddenly reversed, is to stop the engine dead. Some claim that the engine should scarcely feel the reversing of the propeller. A. No reversing gear which is positive in its action should be thrown in suddenly with engine running at full speed. The engine should be stopped or brought nearly to rest before the propeller is reversed. To instantly reverse the propeller at full speed would require an infinite force, and it is not to be wondered at that the attempt to do so should stop the engine. If sufficient time is allowed, the engine will not feel the reversing of the propeller.

(9137) C. S. says: I have a No. 7 Root blower making 100 revolutions per minute; discharge pipe is 24 inches in diameter; the blower is used for a pneumatic cash system of 75 stations. Now I would like to know if I can discharge the exhaust air from the blower into my smokestack without interfering with the draft of my furnaces. I have in use two boilers, 125 horse power each; the stack

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is square, 3 feet x 4 feet 6 inches, and also has an offset a little above the center of the stack. The only place where I could exhaust into the stack now is about five feet *below* the boiler flue, that would be at the bottom of the stack. If I can't exhaust in this place, I would have to carry a line of pipe up on the outside of the building to a point above the boiler flue. Which would be the best? And would I need an elbow in the stack, so the air shoots up, or is it unnecessary? A. You do not give the height of your stack, nor the velocity, pressure and volume of the air from the Root blower, so that it is impossible for us to make any exact calculation; but unless you have a draft very considerably in excess of what you actually require when forcing your boilers, it would not be wise for you to discharge the blower into the stack, because that would have the effect of materially reducing the size of your chimney. On account of the distance of the stack from the boilers, it is more doubtful if you have the draft to spare. In case you try the experiment, insert the discharge pipe from the blower at the base of the stack, with an elbow pointing upward.

(9138) F. A. T. asks: Is there any gain in power by using an Archimedes screw beyond the power required to work an ordinary pump? A. There is no gain in power by using an Archimedes screw over the power required for an ordinary pump. Its efficiency is so low that it is not used in practice, and we therefore cannot tell you where you can see one. The principle of its action is just the same as that of the screw conveyors used for feeding coal into furnaces, to convey grain, etc.

(9139) H. E. asks: 1. Has the Roentgen ray or a similar device ever been perfected to that extent that the human eye can see through a solid body; as, for example, the human hand while the fingers are being moved? A. There is no way known by which the eye can see through an opaque body, such as the hand. By the X-ray we commonly speak of seeing through the hand and other dense bodies. The action is in reality as follows: X-rays traverse many opaque bodies quite freely, but the eye cannot see X-rays. Bones are not easily traversed by X-rays, flesh is. Certain chemical salts transform X-rays into light rays; then the eye can perceive the light rays. On the inside of the box which is held over the eyes is a chemical which thus glows in the X-rays. Place the hand on the end of the box. The bones cut off the X-rays more than the flesh does. The chemical does not glow as much where the bones cut the rays off as where the flesh is, hence the bones cast a shadow on the screen. This is called seeing through the hand. What we see is a shadow. Thick flesh casts more shadow than thinner flesh. By this fact much can be made out regarding the condition of interior organs of the body. It is wonderful enough, but it is not seeing through opaque bodies in any proper sense of the term. 2. Has there been manufactured and in use a slot machine into which a solid body such as the human hand might be introduced and then seen through? A. We do not know whether the slot machine has been applied to X-rays or not. There would be no difficulty in doing this.

(9140) A. C. says: We have a well 184 feet deep that we wish to force water out of to a tank 65 feet above ground. The water stands 16 feet from the top of ground, but we do not know how low it will go when pumping is commenced. The outside casing of well is 8 inches. The suction pipe and discharge pipe is 5 inches. It goes down in the well 163 feet. The air pipe is ¾ inch and goes down 157 feet. The air pressure is 100 pounds. The question is, how far can the water lower and still allow the pumping to go on successfully? In other words, how far must the air pipe be down in proportion to the amount of elevation of water? A. One hundred pounds air pressure will lift a column of water 230 feet high, neglecting friction. The amount of friction will depend on the mechanism used; if the friction is 30 per cent, the 100 pounds air pressure will life a column of water 161 feet high, or from 96 feet below the ground to a tank 65 feet above it.

(9141) J. A. says: I inclose an extract from a letter from John Anderson, Road Commissioner for the State of New Hampshire, in the White Mountains, to Prof. C. H. Hitchcock, of Dartmouth College: "Won't you consult your chemist at Hanover in relation to a fire-extinguishing powder that can be used in fighting forest fires? If we could send one hundred men into the woods, each having hung over his shoulder thirty or forty pounds of such material, which thrown by handfuls into the blazing points or scattered broadcast into a running fire would deaden it, enabling the shovel men to finish it by throwing on fresh earth, we would have a practical solution of the question that is now in the minds of all in this section. In view of the enormous annual loss it might avert, it would not really matter if such material were expensive. It should be provided by the State in all localities subject to these fires." A. Sodium tungstate might answer the purpose, but it would be too expensive. We do not believe that a forest fire will ever be extinguished without resorting to the methods already in use by all lumbermen, such as beating out, denuding the forest to form a fire belt, etc. Powders are better adapted for extinguishing fire in rooms. We think that the chemical fire extinguisher might prove practical for fighting forest fires.

(9142) C. J. S. says: How long is the scaling ladder in use in the New York Fire Department, and where was it invented, and how long is it in use in Berlin? Which is more improved—New York or Berlin? A. The scaling ladders used in the New York Fire Department were first used in 1883, and they run from 12 to 20 feet—12, 14, 16, 18, 20; at about the first time they were used, a very successful rescue was made by now Chief of Battalion Binns. We have no information relative to the scaling ladders in use in Berlin, except that they are used. In general, we may say American-built fire engines are the best made, and we have never heard it questioned that the secondary part of the fire equipment was any less good. Owing to the methods of construction employed abroad they have fewer fires, therefore there is no such demand for improvements in fire apparatus as here.

(9143) S. B. E. writes: If G. B., Notes and Queries, 9,076, of your paper of July 11, will consult "Popular Astronomy," pages 38 to 52 inclusive, by Camille Flammarion, translated by Y. Ellard Gore, he will find the information he is seeking concerning the eleven motions of the earth.

(9144) F. R. M. says: I have been intensely interested in the unusually fine articles on radiation, etc., that have appeared in the SUPPLEMENT during the past four weeks. But there are naturally several statements that I cannot understand or reconcile. Crookes, on p. 23,015, middle of third column, says the "free positive electron is not known." This does not seem to agree with Rutherford's X-rays referred to on p. 22,951, middle column, when they are called positive ions traveling toward the cathode. Is any distinction agreed upon between electron and ion? Will cathode rays act on a photographic plate if let out of the tube through Lenard's aluminium window? and if so, how powerfully compared to Roentgen rays? On p. 22,998, bottom of third column, "unless the gases in the tube are extremely rarefied, the rays are quickly stopped and scattered by molecular obstructions." Then why are not the rays immediately stopped and scattered when they reach the air after passing through the aluminium window? Dastre, on p. 22,998, middle of second column, says cathode emission is rectilinear. Crookes, on p. 23,015, middle of second column, says electrons "can turn corners." How can these be reconciled? A. We do not wonder that you are at a loss sometimes among the varied and well-nigh contradictory statements concerning electrons and other minute things claimed to exist by the more advanced theorizers. It is, of course, the office of a scientific periodical to print the papers read at the various meetings of scientific bodies, but they rest for authority, not upon the periodical, nor upon the society, but upon the repute of the persons presenting them. We cannot decide between the claims of the several scientists, but must leave the matter just where they leave it. Only one engaged in investigation can speak with any authority about such matters as you refer to in your note.

(9145) O. N. writes us: Is a 16 candle power bulb frosted more luminous than one that is not frosted? That is to say, will one 16 candle-power frosted bulb give more light than one that is not frosted? A. An incandescent electric lamp with clear glass bulb will emit more light than one with a frosted bulb. The bulb cuts off light. No arrangement of the bulb can increase the light of the filament. It is the filament which gives the light, and not the bulb. Even a bulb of clear glass absorbs some light. One of partly opaque glass will, of course, absorb more light.

(9146) N. A. N. says: Will you please decide if there is a difference between a mile square and a square mile? I hold that a mile square is a mile around it, and a square mile is four miles around it. A. A "mile square" and a "square mile" have each the same area, but the phrases have very different meanings. A mile square is a figure one mile on each side, and all its corners right angles. A square field one mile on a side is a mile square. A square mile contains 640 acres, and may be in any shape whatever, circular, rectangular, etc., or of any irregular form.

(9147) F. A. F. asks: Kindly answer the following mathematical problem to set your readers right: We have an aquarium, a globe, 6¼ inches in diameter, 6½ inches high; the question is, How many pellets or buckshot ¼ inch in diameter will this globe or aquarium hold? A. The problem you send us may admit of a mathematical solution, but so far as we know it only admits of solution by experiment. Fill the globe with shot and count them. The globe is apparently an irregular solid. You give the dimensions as 6¼ x 6½ inches. This is not a spherical solid, and its shape is not determined by two dimensions only. The rate of curvature of its parts is not given by knowing two dimensions only. If it be assumed that the dimensions are the axes of an ellipse, then the solid is an ellipsoid of revolution and its form is definitely known. But it can hardly be assumed that a globe of glass blown by ordinary processes of the shop is an ellipsoid of sufficient accuracy to base a mathematical calculation upon. If its solid contents simply are known, the number of spheres which it would contain could not even then be calculated without more data. And if the problem were solvable, what would be the use of doing it? We are fond of working upon problems which lead to results of practical value, and though we sometimes work out problems for correspondents, which are simply puzzles, we always feel that the time is misspent, since we are beyond the age when we do such work simply for mental gymnastics.

(9148) A. L. asks: 1. What is the best kind of iron or steel to make a magneto? A. A magnet may be made of tool steel. The higher the grade of steel, the better. 2. What is the best method of making a magnet the most powerful? A. The magnet should be hardened at the ends as hard as it can be made. The middle may be soft. It can then be magnetized by stroking with another magnet or the poles of a dynamo, or by placing it in a coil of wire through which a current of electricity is flowing. All these methods are fully described in textbooks. 3. When a magnet's lifting power is 6 pounds and the object it is lifting is a magnet weighing about 7 pounds and having a lifting power of also 6 pounds, will the former lift it, or must the latter weigh exactly six or lower? A. If a magnet can lift six pounds, it can lift anything less than six pounds. If one of two magnets can lift seven pounds, it will hold up seven pounds or hold itself up against the other if suspended from it. 4. Has a magnet the same amount of repelling force as attractive? A. A magnet will repel with the same force as it attracts. The lifting power of a magnet means that it will lift in actual contact with the weight to be lifted, and not at any distance from it through the air. A narrow gap of air reduces the power of a magnet very greatly.

(9149) W. C. B. says: I am informed that there is a process for making ice whereby liquid air is utilized in place of ammonia; that the installation of a plant of that character can be installed for much less money than the ammonia plant; that the maintenance is much less than the ammonia plant; and that it has other advantages. Will you be kind enough to give me some information on this subject? Is it in its experimental stage, or is the system being used to any extent? Can the tubes of air be secured commercially like ammonia? I am told they are used principally for small plants, but that larger plants use the ammonia. In your opinion, would a plant of 20-ton capacity per twenty-four hours be manipulated more economically with the air or the ammonia systems? A. We think we are safe in saying that nowhere in the world is liquid air in use for ice-making or refrigeration, and in our judgment it will be a long time before it is used for any of these purposes. It is many times as expensive as the ammonia process, and has other disadvantages in comparison with it.

(9150) A. S. asks: A friend of mine says if a piece of iron is laid where the sun can shine on it, it will get hotter than a thermometer would show the atmosphere to be. I claim he is wrong. If it would be as he says, the iron would have the property of drawing heat, and an iron pail of water would show a greater registration on a thermometer than the air would. Nearly every one I have spoken to says he is right, so as a last resort I turn to you. A. Any metal laid where the sun can shine fully upon it and at the same time be protected from drafts of air will become much hotter than the adjacent air. We have just laid out a roll of sheet copper in which was a thermometer. The ends were closed by paper to protect the air from passing through the roll and cooling the thermometer. By its side in the sun was another thermometer, and still a third was in the shade close by. The thermometer in the shade showed 82 deg., that in the sun showed 122 deg., while the one in the copper roll read 138 deg. As the mercury rose to the very top of the bore of the stem, it is not certain but that the temperature was higher still. Any one who ever picked up a piece of iron which had lain in the sun of a summer day and found it too hot to hold in the hand, knows that the air in the neighborhood is cooler than the piece of iron; or if as a boy you have walked barefooted over stones, or in the sand, on which the sun shone with full force, and had your feet burned, the same fact could have been learned. The scientific reason for this is not difficult to understand. Water is used as the standard for measuring the quantity of heat required to produce a certain rise of temperature. One pound of water is raised 1 deg. by a certain quantity of heat. It will require only one-fourth as much heat to raise a pound of air one degree, one-eighth as much to raise a pound of iron one degree, and one-tenth as much to raise a pound of copper one degree. The same quantity of heat produces very different effects upon different substances upon which it strikes.

(9151) A. F. O. says: I know all about the ordinary thermometric scales, F., C., and R., and their mutual reductions, but "600 deg. A" in President Swinburne's address in the SUPPLEMENT is new to me. Will you kindly enlighten me? A. "600 deg. A" are degrees of absolute temperature. The absolute zero is 273 deg. below the Centigrade zero. Temperatures are often expressed in the absolute scale, since then the relations are in an exact ratio to each other. 400 deg. A is twice as hot as 200 deg. A. Of course 400 deg. C. is not twice as hot as 200 deg. C., since both are reckoned from the freezing point of water, which is not a real zero of heat. Ice is still 273 deg. C. above zero.

(9152) C. H. S. asks: 1. Without using wireless telegraphy, is there any way to receive a current of magnetism or of electricity from one boat to another, 100 feet or less away, to affect the needle or an electrometer? A. We do not know any way of sending and receiving electrical signals which is not equivalent to wireless telegraphy; that is, an induction coil and receiving instruments, such as a coherer of telephone, or some equivalent electromagnetic device must be used. 2. Can an electrometer be made to register such a current, no matter how feeble? Don't mean to telegraph or telephone. A. An electrometer is not the instrument to employ. It receives and registers static charges, not currents. A galvanometer is probably intended. This may be used in the way mentioned.

NEW BOOKS, ETC.

THE ELEMENTS OF ELECTRO-CHEMISTRY TREATED EXPERIMENTALLY. By Dr. Robert Lüpke. Revised and augmented by M. M. Pattison Muir, M.A. London: H. Grevel & Co. Philadelphia: J. B. Lippincott Company. 1903. 8vo. Pp. 255. Price, $2.25.

Although the main purpose of the book is to set forth the purely scientific aspects of electro-chemistry, the practical sides of the subject have not been left altogether unnoticed. Technical electro-chemical processes, and especially the processes of electro-metallurgy, which are so important at present, are referred to in their proper places. The experiments, which form an essential part of the book, are carried out with the simplest possible apparatus.

LES INDUSTRIES CHIMIQUES ET PHARMACEUTIQUES. Par Albin Haller. Paris: Gauthier-Villiers. 1903. Vol. I. 4to. Pp. 405. Vol. II. Pp. 445.

In these two stately volumes Prof. Haller reports on the chemical and pharmaceutical industries which were represented at the last Paris Exposition. After a scholarly introduction he discusses the chemical industry of every European country and of the United States, passing then to improvements introduced since 1889. His second chapter discusses pharmaceutical products and minor improvements, not the least valuable portion of the chapter being devoted to a *résumé* of antiseptics and antipyretics. In a chapter on artificial colorants and the raw material from which they are made, Prof. Haller gives an admirable review of the development of this important branch of organic chemistry since 1889. The products of the distillation of wood, resins, coal, and mineral oils are treated in a chapter by themselves, as are also artificial and natural perfumes. The sixth chapter is taken up by descriptions of mineral colorants or pigments, lacquers, varnishes, paints, inks, blacking, and the like. In the seventh chapter soap-making and stearine industries are treated.

DIE WEISSGERBEREI, SAEMISCHGERBEREI UND PERGAMENT-FABRIKATION. Ein Handbuch fuer Lederfabrikanten. Von Ferdinand Wiener. Vienna: A. Hartleben. 1903. 12mo. Pp. 376. Price, $1.75.

Mr. Wiener's book is essentially a practical reference book for the leather manufacturer. Its style is such that the process described can be comprehended even by the layman. In this second edition of his work Mr. Wiener has carefully revised the text and incorporated descriptions of the more important improvements which have been made since the appearance of the first edition.

TECHNIK DER RADIERUNG. Eine Anleitung zum Radieren und Aetzen auf Kupfer. Von Josef Roller. Vienna: A. Hartleben. 1903. 12mo. Pp. 376. Price, $1.25.

Prof. Roller's handbook on etching is intended not only for the artist, but also for the art connoisseur. The work discusses thoroughly and clearly the various operations of etching on copper, and likewise contains many an interesting remark on artistic printing and a very instructive review of the various calcographic methods.

THE CHEMISTRY OF PIGMENTS. By Ernest J. Parry, B.Sc., and John H. Coste, F.I.C., F.C.S. London: Scoot, Greenwood & Co. New York: D. Van Nostrand Company. 1902. 12mo. Pp. 280. Price, $4.50.

The publishers of this work have a reputation for issuing important books upon technical subjects and the present book fully sustains this reputation. It indicates the chemical relationship, composition, and properties of most of the better known pigments. The various colors are treated in groups allied chemically, rather than chromatically; an excellent arrangement. The methods of manufacture of colors have been considered rather from the chemical than the technical point of view. It is not suggested by the authors that the present work is in any

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sense a manual of color making, but it will be found most useful by those who are called upon to examine pigments as a guide to the selection of those which are suitable and the rejection of those which as a class, or through individual inferiority are unsuitable for the class of work to be undertaken.

EASY LESSONS IN ROOF MEASUREMENTS. By William Neubecker. New York: David Williams Company. 1903. 16mo. Pp. 31. Price 25 cents.

Twelve short lessons on figuring from architects' or scale drawings the amount of material required to cover a given surface in flat, hipped, or irregular-shaped roofs.

THE ROENTGEN RAYS IN MEDICINE AND SURGERY AS AN AID TO DIAGNOSIS AND AS A THERAPEUTIC AGENT. By Francis H. Williams, M.D. New York: The Macmillan Company. 1903. 8vo. Pp. 757. 428 illustrations. Price, $6.

No discovery of modern times has made a more profound sensation than the discovery of the Roentgen rays, and it is fortunate that instead of being a scientific plaything it has been put to practical use in the diagnosis of disease, and as a remedial agent. In two years there have been three editions of the volume before us, the first edition being exhausted in three months. The descriptions of the apparatus and methods employed are clear and concise, and the half-tones of radiographs are well executed. The subject is treated in a scholarly way and the book is one which we commend not only to the physician, but to the physicist as well.

ELECTRIC WIRING. A Primer for the Use of Wire Men and Students. By W. C. Clinton, B.Sc. New York: E. P. Dutton & Co. 16mo. Pp. 179. Price, 60 cents net.

This little book is intended as an introduction to the art of indoor electric wiring as practised in the fitting up of private houses, stores, etc., with lamps and bell circuits. Worked examples have been given where possible. The book is intended specially for the use of those preparing for the preliminary examination of the City and Guilds of London Institute. We have already expressed our opinion of the English examination system in this column. The practice is, of course, English, but it will prove useful as well to the American student. We regret to note that the title page has no date. All scientific books should be properly dated.

AN INTRODUCTION TO THE STUDY OF TEXTILE DESIGN. By Aldred F. Barker. New York: E. P. Dutton & Co. 1903. 8vo. Pp. 211. Price, $2.50.

A most admirable book. The primary object of this work is to show clearly how the special knowledge required in the textile industries may be co-ordinated into a truly educational discipline. The numerous plates and design sheets are admirably engraved and printed and the diagrams showing the principles upon which textile machinery is based are the best we have ever seen. The chapter on the Science of Cloth Construction is particularly valuable. It is a book which should be in the hands of all those connected with mills.

THE PRINCIPAL SPECIES OF WOOD. Their Characteristic Properties. By Charles Henry Snow, C.E., Sc.D. New York: John Wiley & Sons. 1903. 8vo. Pp. 203. Price, $3.50.

An excellent book, admirably illustrated by thirty-nine full-page plates and many figures in the text. It is intended for those who are not foresters or botanists, but who use woods or desire knowledge of their distinguishing properties, therefore it will appeal especially to engineers, but all who have occasion to use woods will find it of great value. Under "Live Oak," for instance, we find that the author deals with Nomenclature, Locality, Features of Tree, Color, Appearance or Grain of Wood, Structural Qualities of Wood, Representative Uses of Wood, Weight of Seasoned Wood in Pounds per Cubic Foot, Modulus of Elasticity, Modulus of Rupture, Remarks. Other woods are treated in a similar manner.

FOREIGN TRADE REQUIREMENTS. New York: Lewis, Scribner & Co. 1903. 4to. Pp. 532. Price, $10.

This reference volume, which is published annually, contains complete information concerning the commercial countries of the world as to trade conditions, traveling salesmen, agencies, and advertising, credit customs, commercial, trade-mark, and patent laws, transportation facilities, principal cities, postal regulations, coins and currencies, weights and measures, and cable rates. While the book was issued primarily for the benefit of the American exporter, the demand for it from England and Germany has been large, and this proves that the manufacturers of these countries are keenly alive to the necessity of utilizing every possible aid for the extension of their foreign business. The work has been conscientiously done, and the book cannot but prove of great value.

THE IMPROVEMENTS OF RIVERS. By B. F. Thomas and B. A. Watt. New York: John Wiley & Sons. 1903. 4to. Pp. 356. 92 full-page and folding plates. Cloth, $6.

The second title is "A Treatise on the Methods Employed for Improving Streams for Open Navigation and for Navigation by Means of Locks and Dams." This is the first work of its kind published in the English language, although engineers have long recognized the value it would be to the profession to have a treatise covering the principal features of that branch of enginering pertaining to the improvements of rivers. This branch comprises a great variety of works: Locks and Dams for Canalization, Dikes and Jetties for Concentrating and Controlling Streams and Bank Protection in Regularization, Levee Building and Storage Reservoirs for the Prevention of Inundations, and Dredging and Snagging for Keeping Channels during Times of Low Water. The object of the work is to provide in concise form a description of the various systems employed for bettering the condition of navigable streams, together with the methods usually adopted for their design and execution. It is an admirable contribution to engineering literature.

STORAGE BATTERY ENGINEERING. By Lamar Lyndon, B.E., M.E. New York: McGraw Publishing Company. 1903. 8vo. Pp. 382. Price, $3.

The evident and long unfulfilled need of a practical work on the storage battery, particularly adapted for electrical engineers who are not chemists, and on the details of its engineering applications, has induced the preparation of this work which is intended to assist the practising engineer in designing, installing, and maintaining battery equipments and to guide him in the selection of types of batteries and auxiliary apparatus best suited to the service which they are to perform and at the same time to impress on the technical public both the advantages and limitation of the storage battery in practice. The author has performed an extremely difficult task in a most acceptable manner.

FIRE INSURANCE AND HOW TO BUILD. By Francis C. Moore. New York: The Baker & Taylor Company. 1903. 8vo. Pp. 860. Price, $5.

It will prove a convenient book for architects, builders, and property owners who contemplate erecting buildings, enabling them to make inexpensive structural alterations which would secure lower insurance rates and save the burden of a lifelong insurance tax. The idea and plan of this book are excellent. The systems in use by the Fire Underwriters for determining rates are very complicated and are puzzling to the lay mind, but with the aid of this book the principles which underlie the formation of a rate will be understood. The work also deals with fire prevention and extinction, special features of manufacturing risks, the writing of policies, the adjustment of losses, etc.

MODERN MEXICO'S STANDARD GUIDE TO THE CITY OF MEXICO AND VICINITY. By Robert S. Barrett. Published by "Modern Mexico," the City of Mexico and New York. 1902-3. 8vo. Pp. 186, profusely illustrated. Price, 50 cents.

An admirable guide which should prove indispensable to all tourists. The illustrations are happily chosen, the plates have been well executed, and the printing is excellent. There is not a feature of the city, important or unimportant, which is not properly dealt with.

TREATISE ON HYDRAULICS. By Mansfield Merriman. New York: J. Wiley & Sons. 1903. 8vo. Pp. 585. 192 illustrations. Price, $5.

The eighth edition has been rewritten and enlarged, which was rendered necessary by the many advances which have been made in hydraulics since 1889, when the first edition of this treatise was issued. Too much cannot be said in praise of this admirable book which is a standard text book for engineers and engineering students. It deals with the entire range of hydraulics, taking in the flow of waters through orifices, tubes, pipes, and over weirs. It also deals with the flow of rivers, water supply and water power, water wheels, turbines, naval hydromechanics, and pumps and pumping.

EXPERIMENTS ON THE FLEXURE OF BEAMS. Resulting in the Discovery of New Laws of Failure by Buckling. By Albert E. Guy. New York: D. Van Nostrand Company. 1902. 12mo. Pp. 122. Price, $1.25.

The study of the failure of beams by the buckling of the compression side has been strangely neglected and now that it has been taken up it proves to be the central fact and key to the entire subject when looked at in the broadest sense. The analogy of the failure of the compression side of a beam by buckling to the method of failure of a long column was, of course, long ago remarked, but we believe that there has been no previous attempt to connect the two by a formula. Mr. Guy's experiments have been very successful in connecting them and in showing that Euler's formula for long columns is, in fact, the fundamental formula which lies at the base of the whole subject.

HAND BOOK OF CLIMATOLOGY. By Dr. Julius Hann. Part I. General Climatology. New York: The Macmillan Company. 1903. 8vo. Pp. 437. Price, $3.

Dr. Hann's book has been translated by Prof. Robert de Courcey Ward, of Columbia University. The writer undertook the work primarily in order that it might serve as a textbook in the course in general climatology in Harvard University. At the same time the publication of a standard work on climate will, he hopes, lead to the extension and improvement of the teaching of scientific climatology in English-speaking countries. The work is a very important one, and this new edition is an excellent contribution to the literature of meteorology.

THE NEW ONION CULTURE. By T. Greinier. New York: Orange Judd Company. 1903. 16mo. Pp. 114. Price, 50 cents.

A complete guide in growing onions with the greatest profit, explaining the whys and wherefores. Clear and minute directions are given of how the plants are grown; the cold frame; seed bed; planting; fire hotbed, hotbeds heated by steam; cheap greenhouse for market gardeners; greenhouse heated by hot water; quantity of seed required; time of sowing; varieties; what soil to select; how to manure and prepare it; onions on muck soil; clean soil essential; how the plants are set in the ground; tillage as moisture preserver and weed killer; tools of tillage; when and how to harvest the crop; danger in delay; signs of maturity; curing the crop; curing sheds; weight of crop; wintering onions; advantages and profits of the new way; estimation of cost and returns.

THE RESISTANCE AND POWER OF STEAMSHIPS. By W. H. Atherton, M.Sc., and A. L. Mellanby, M.Sc. Manchester: The Technical Publishing Company, Ltd. 1903. 16mo. Pp. 200. Price, $2.

Almost all the recognized methods of determining the engine power required to propel steamships are discussed in considerable detail, and examples of their application given. The subject of the fouling of ships has also been dealt with fully, because of its important influence on the actual resistance of seagoing ships. The book will appeal to marine engineers and shipbuilders, and, in fact, to all who are interested in watching the development of steamships.

A HAND BOOK ON THE STEAM ENGINE. With Special Reference to Small and Medium-Sized Engines. By Herman Haeder, C.E. Translated by H. J. P. Powles. London: Crosby Lockwood & Co. New York: D. Van Nostrand Company. 12mo. Pp. 458. 1,085 illustrations. Price, $3.

The present volume is profusely illustrated by very helpful engravings, and the number of tables is surprisingly large. The best Continental practice is given. The book shows the results of practical experience of engineers.

TECHNICAL MYCOLOGY. The Utilization of Micro-organisms in the Arts and Manufactures. By Dr. Franz Lafar. Vol. II. Eumycetic Fermentation. Part I. London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Company. 1903. 8vo. Pp. 189. Price, $4.

A practical handbook on fermentation and fermented process for the use of brewers and distillers, analysts, technical and agricultural chemists, pharmacists, and all interested in the industries dependent on fermentation. The first volume dealt with Schizomycetic Fermentation.

THE UTILITY OF AN ACADEMIC OR CLASSICAL EDUCATION FOR YOUNG MEN WHO HAVE TO EARN THEIR OWN LIVING AND WHO EXPECT TO PURSUE A COMMERCIAL LIFE. An Investigation. By R. T. Crane. Chicago. 1903. 16mo. Pp. 109.

SIMPLE SCIENTIFIC EXPERIMENTS. By Aurel de Ratti. London: Dawbarn & Ward, Ltd. 1903. 16mo. Pp. 69. Price, 20 cents.

INFORTUNI SUL LAVORO. MEZZI TECNICI PER PREVENIRLI. By Effren Magrini. Milan: Ulrico Hoepli. 1903. 16mo. Pp. 251. Price, 75 cents.

INDEX OF INVENTIONS

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July 28, 1903,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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Acid, making sulfuric, G. Gin 734,849
Advertising device, J. D. Smith 734,982
Air compressors, controller for hydraulic, W. J. Linton 734,904
Air inlet, fresh, R. S. Watson 735,007
Air to buildings, apparatus for supplying cool, A. Siebert 734,975
Alkaline earth dioxids, making hydrates of, G. F. Jaubert 734,713
Amalgamator, G. C. Scott 734,618
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Angle bar and rail shoe combined, graduated reinforced, G. H. Williams 735,025
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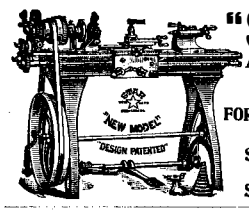
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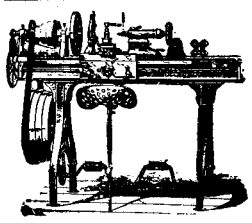
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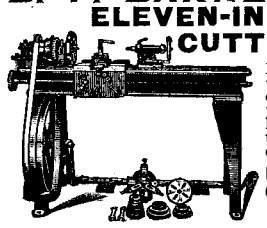
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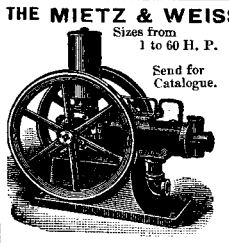
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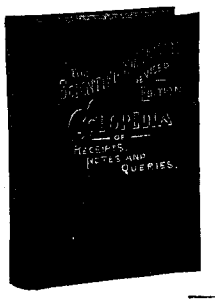
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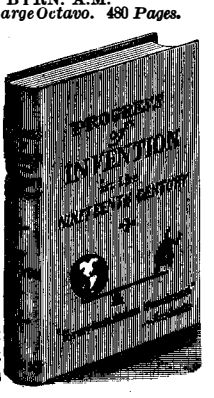
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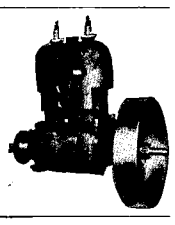

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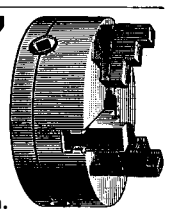

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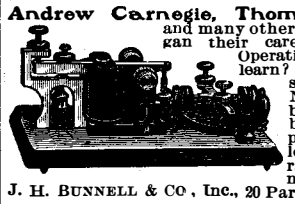

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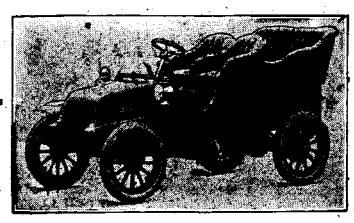

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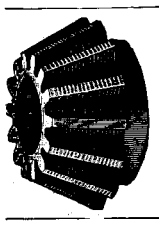

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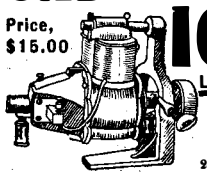

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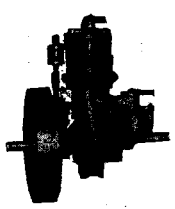

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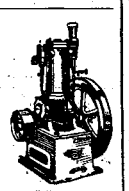

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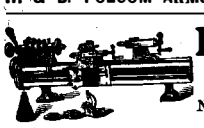

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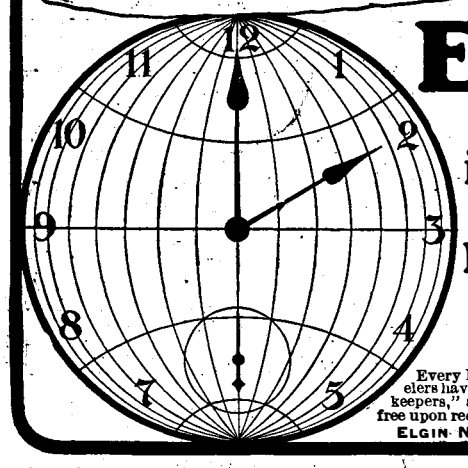

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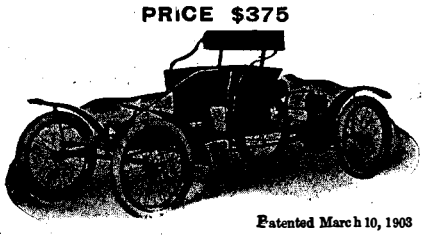

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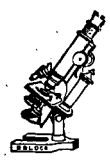

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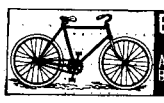

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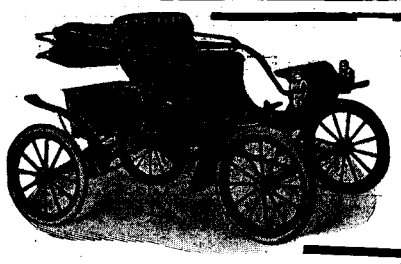

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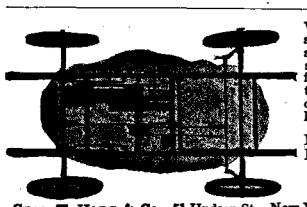

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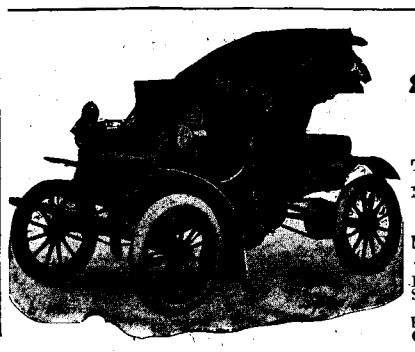

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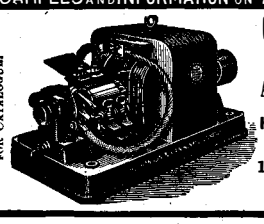

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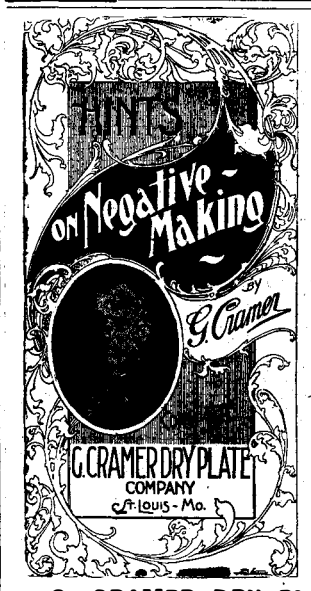

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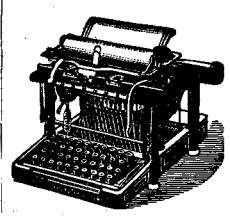

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